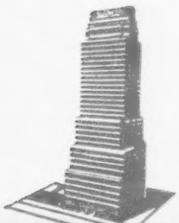
MID-DECEMBER, 1938

POWER



A McGRAW-HILL PUBLICATION

VOL. 82 • NUMBER 13

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NEXT MONTH

• *Essex Tops at 950 F*

Six years of experience led to the installation of the highest steam temperature yet proposed for commercial operation.

• *Sheffield Makes Steam, Buys Power*

New York's newest milk plant puts in an all-around power-service job—refrigeration, heating, power, process steam. Interesting are the reasons for combining purchased power and generated steam.

• *What's Next in Diesel Fuels?*

John M Drabelle, who has had much to do with diesel central stations operated by Iowa Electric Light & Power Co, looks through the eyes of an operator at new fuels and new problems the future may bring.

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Piping in Mash Room, Joseph E. Seagram & Sons, Inc. distillery, Louisville, Ky. National Industrial and Power Equipment Co., Cincinnati, Contractors and Engineers. Joseph & Joseph, Louisville, Architects and Engineers.

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Selection of piping materials for maximum life at minimum cost is a difficult job. We can help you with it. If you will write, outlining your particular corrosion problem, our Engineering Service Department will (1) determine the probable corrosive conditions; (2) relate these to similar conditions encountered elsewhere; (3) interpret the results in the light of 75 years experience, and (4) make recommendations . . . supported by service records. Ask, too, for the bulletin, "Wrought Iron in Piping Systems."

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POWER

Established 1882 PHILIP W SWAIN, Editor

Power Show in Print

MANY THOUSANDS of engineers visited New York during the week of December 4, to see the Power Show, attend ASME sessions and meet old friends. Other thousands were kept away by distance or inability to leave their jobs. This Mid-December number—our own "Power Show in Print"—is for both groups.

At the end of the year all engineers—even those who took in both Power Show and ASME—still face the need of "catching up" fully with power progress. They need a quick summary of the year's events, trends and thinking to fix in mind the things already learned and to bring them the essence of things overlooked.

With this end in view, we present here seven high-speed reviews, geared to the needs of men who want the practical essentials, but have no time to waste:

One: *Equipment Review*—a condensed recapitulation of 300 new equipment descriptions that appeared in *Power* during 1938, plus 60 additional items received in the past month.

Two: *Our own private review of 1938*—engineering events and important trends. Also a forecast of general business and power-field activity for 1939.

Three: *New Steam Installations*—an elaborate tabulation of basic data on important utility and industrial steam power jobs of 1938, including new plants, extensions, modernizations.

Four: *New Hydro Installations*—a similar tabulation for hydro plants, including the government projects so much in the limelight today.

Five: *Power Show Report*—highlights of equipment trends, based on an intensive study of the outstanding exhibits of this year's Show.

Six: *ASME Report*—nine pages giving the meat of all power-field papers presented at the Annual Meeting—news for those who stayed at home—an easy-to-read summary for those who attended.

Seven: *ASRE Report*—Two pages high-spotting the meeting of the refrigerating (and air-conditioning) experts.

Taken as a whole, this number is a "Power Show in Print" in every sense of the word. Within one pair of covers it sums up the power progress of the year—the big events, the "little" events that will grow big, the new equipment, the new plants, the new thinking. It brings to every reader the opportunity to clear up in one evening the unfinished mental business of 1938 and thus prepare himself for the greater opportunities of 1939.

We mean this "greater opportunities" quite literally. As noted in more detail on page 77, every sign points to a strong and steady upswing that will carry general business far above its present levels. More wheels will turn everywhere. More steam and power will be needed, and more of every power service. Utility and industrial loads will boom. The demands of onrushing loads and deferred modernization will fill equipment shops with orders. Engineers who know the signs and the trends will make things happen fast—each in his own private bailiwick.

Review of Power and Mechanical Equipment

In the 35 pages that follow, POWER *presents its eleventh annual review of new and improved equipment. The 360 descriptions presented here are summaries of those which have appeared in* POWER *since January 1, 1938, plus 60 additional items received in the past month.*

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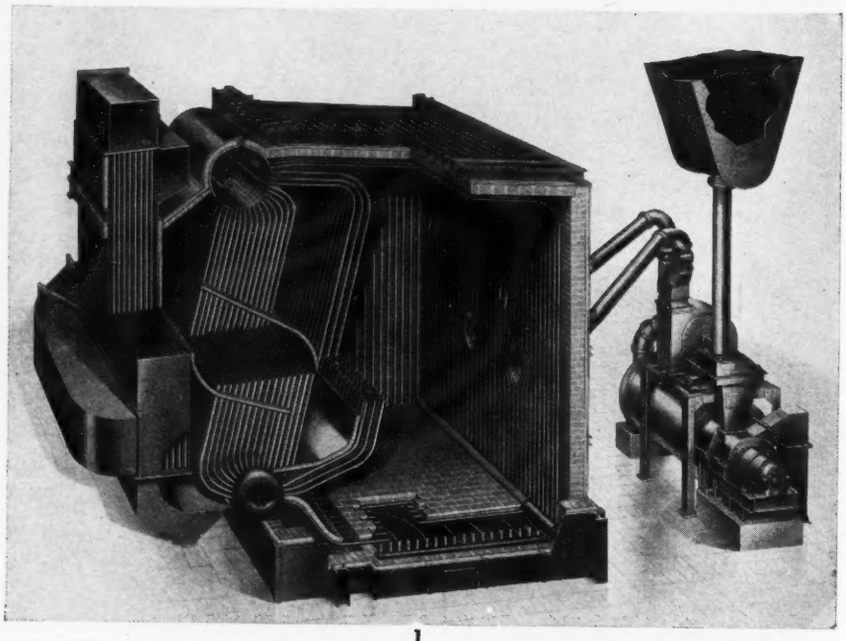
BOILERS, STOKERS, REFRACTORIES AND ACCESSORIES

1 STEAM GENERATOR — Pulverized-coal-fired boiler consists of two drums connected by a system of bent tubes, both boiler and waterwall. The two drums are one above the other with varying distances between horizontal centers and are connected by boiler tubes arranged in semi-vertical position. Waterwall tubes completely enclose furnace on three sides as well as roof and floor, and connect waterwall headers with top steam and water drums. Feeder and floor tubes connect waterwall headers directly with bottom water-storage drum. Under normal conditions, unit is furnished with streamlined monolithic baffles, arranged for cross flow of gas in three passes across boiler tubes. "Shadow" or reflecting wall, produced by arranging boiler setting 4 in. behind waterwall and arch tubes, is said to make full circumference of tube effective heat-absorption surface. *Kennedy-Van Saun Mfg & Engrg Corp, 2 Park Ave, New York, N. Y.*



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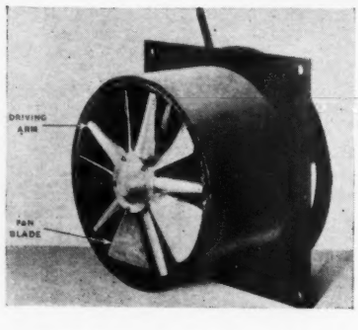
2 GAS BURNER — "Fanmix" rotary gas burner is a long-hub fan in which two ball bearings are mounted so that fan rotates on a stationary shaft that serves as gas-inlet pipe. Gas is admitted through hollow shaft and enters fan hub. Fan has driving arms as well as air blades. Gas flows to these arms, leaves through small orifices and, by reaction, causes the fan to rotate at high speed. Fan blades then act as any other power-driven fan, delivering air for combustion. Number of orifices in driving arms as well as gas pressure determines amount of gas flow, and reaction force determines fan speed and air delivery. Operates at gas pressures of 5 to 40 lb. *Coppus Engineering Corp, Worcester, Mass.*



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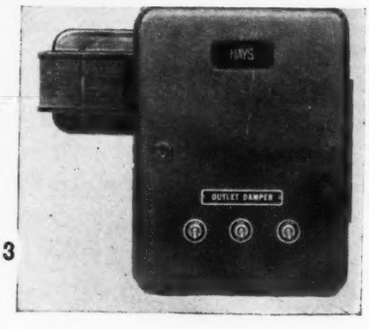
3 FURNACE-DRAFT CONTROL — Sequence furnace-draft control is designed to prevent blowback that occurs during ignition period in on-and-off oil and gas burners and stokers. Electrically operated control is precisely timed



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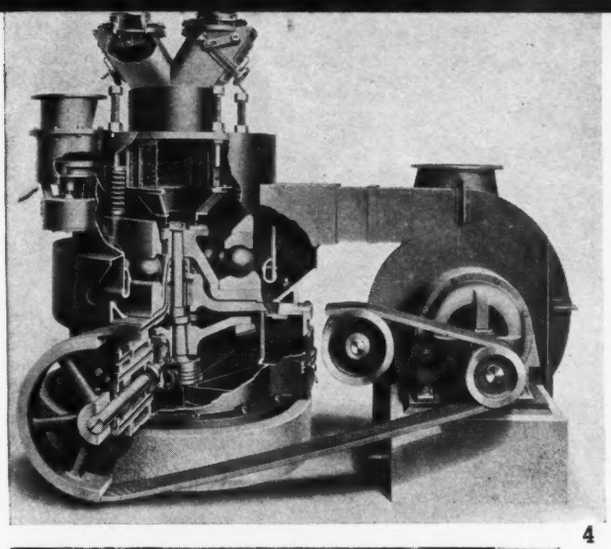

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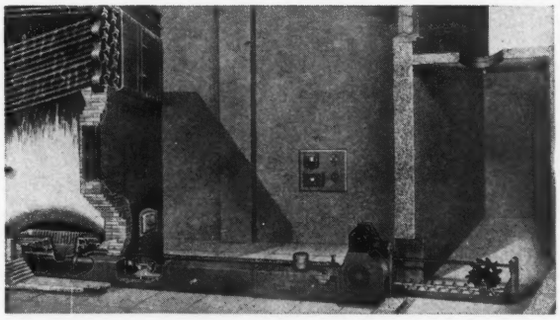

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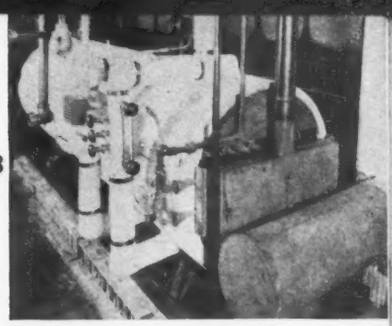

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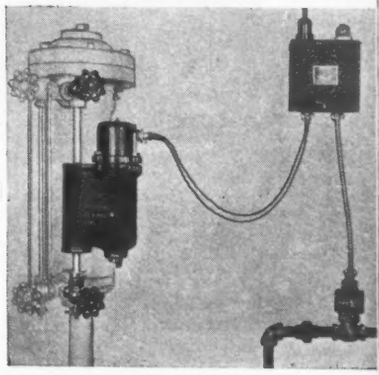

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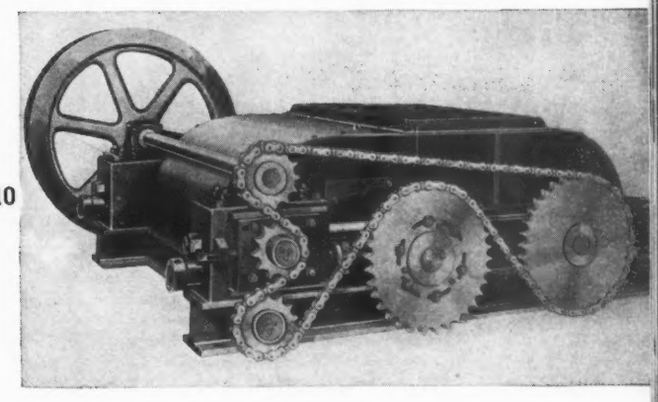

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to open wide up-take damper an instant before burner or stoker comes on, thereby preventing buildup of pressure. *The Hays Corp, Michigan City, Ind.*

4 COAL PULVERIZER—Type E pulverizer uses ball-bearing principle of pulverizing common to all B&W Type B units, and supplants the latter in a certain range of sizes, 2.5 to 15 tons per hr. High capacity for given size, and power consumption as low as 9 kwhr per ton of Pittsburgh seam coal pulverized to pass through 200-mesh, result from outward radial flow and improved classification of fines. Improved ball material and increased capacity give low maintenance costs. *Babcock & Wilcox Co, 85 Liberty St, New York, N. Y.*

5 STOKER—"Coal Flow" stoker, for boilers up to 3000 sq ft, has integral coal-conveying mechanism, so that coal is brought automatically from main bunker to fire. All operating mechanism is in boiler room, outside coal bunker. Electrically controlled automatic firing maintains desired steam pressure regardless of peak loads. Other features include: metering feed worm, volumeter air regulator that gives automatic control of air in combustion zone, and centro-balanced rotor fan. V-belts on both transmission and fan drives. *Iron Fireman Mfg Co, 3170 W 106th St, Cleveland, Ohio.*

6 WELDED BOILER — Developed for oil fields, this Class I, 1300-sq ft, welded locomotive-type boiler is for 300-lb working pressure. Designed according to ASME standards and constructed under supervision of Hartford Steam Boiler Inspection & Insurance Co. Welded seams are used in barrel, dome, firebox and tube sheet. This does away with overlapping plates and reduces boiler weight by about 10%. *Farrar & Trefts, Inc, Buffalo, N. Y.*

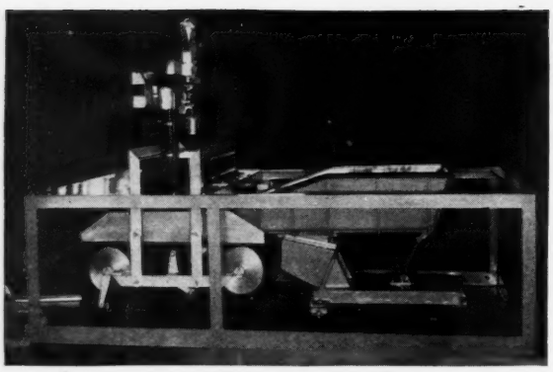
7 DESUPERHEATER—Operates on steam from 212 to 1100 F, maintaining within close limits desuperheated-steam temperature. Flow of cooling water is controlled at spray nozzle. Constant pressure drop is maintained across nozzle, permitting continuous supply of cooling water to be sprayed into superheated steam in proportion to demand, from minimum to maximum flow. Boiler feedwater can be used as cooling water. Air or water can actuate pilot operator of water-control valve. *Northern Equipment Co, Erie, Pa.*

8 GAS BOILER—Immersion horizontal fire-tube gas boiler is automatic and continuous in operation. Tubes are under water for their entire length. Heat is supplied through a series of tubes making two complete passes each and giving 14 ft of flue-gas travel each. 8-in. space between boiler bottom and lowest tubes is for collecting sediment, which can be removed by blowdown. Firing is by a battery of immersion gas burners, each of which fires into the end of one tube. The first pass of tubes is in the upper portion of the boiler and the return is in the lower. As the hottest portion of these tubes is just below water level, steam is generated quickly while water in bottom is receiving quick preheat from waste products of combustion. *Sellers Engrg Co, Chicago, Ill.*

9 BOILER-WATER CONTROL — Improved automatic boiler-water control has redesigned electrode holder installed either in gage-glass tappings by "Y" fittings as illustrated, or with equalizing pipe. This holder completes an electric circuit when boiler-water level falls below normal, water itself acting as conductor between two electrodes and ground to operate electric feed valve or control a feed pump. A third electrode provides for low-water cutout circuit. *Johnson Corp, Three Rivers, Mich.*

10 COAL CRUSHER—Two-roll spring-relief coal crusher has unbreakable all-welded steel framework and cut-tooth wheels. "Silver-link" roller-chain drive to both rolls from crusher countershaft mounted on anti-friction bearings. Roll shafts are carried on heavy rigid bearings, with one shaft adjustable to vary size of product or to compensate for wear. Adjusting sleeves have relief springs as protection against excessive stresses, and any shock from these springs is transmitted directly to welded frame. Segmental rolls have cast-iron spiders to which are bolted heavy alloy-iron segments, heat treated to a Brinell hardness of 500 to 600. *Link-Belt Co, 307 N Michigan Ave, Chicago.*

GAGE GLASS—"Pyrex" broad red-line gage glass differs from previous types in that red stripe is transparent, is proportioned to diameter of tube, and is fused permanently to wall of gage glass. Transparent red line makes it possible for the first time, it is said, for light to pass through red stripe and water column from rear. A small slotted illuminator directly back of gage glass produces brilliant visibility under all conditions. Made in lengths to 24 in. and diameters ½ to 1 in. inclusive. *Corning Glass Works, Corning, N. Y.*



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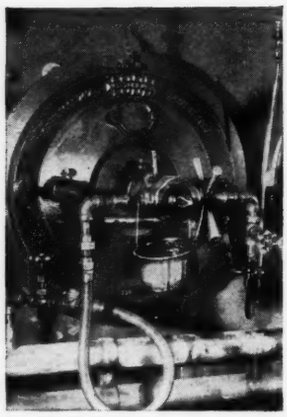

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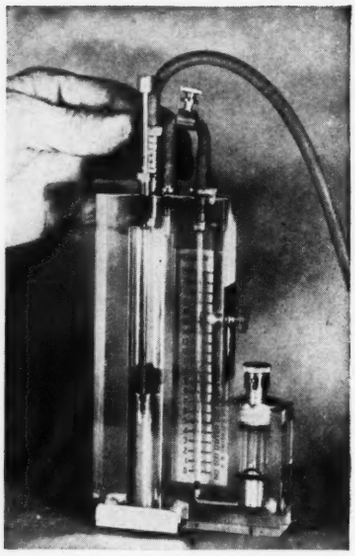

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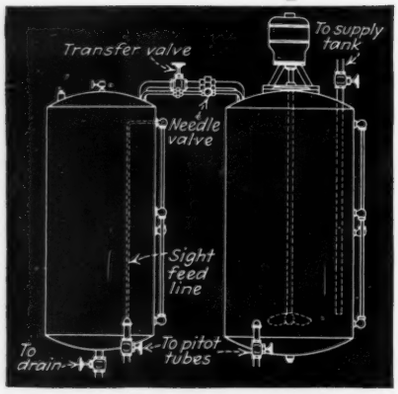

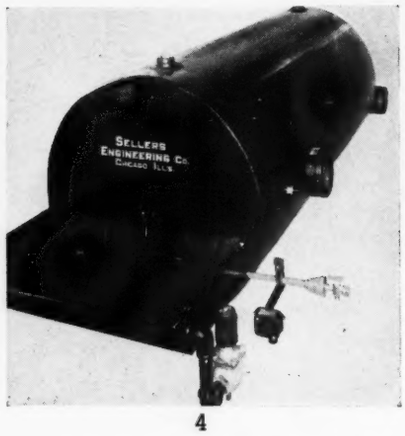

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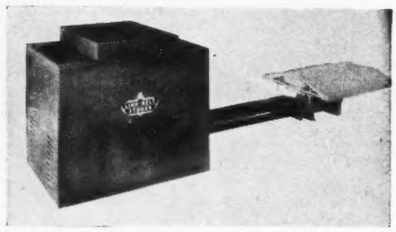

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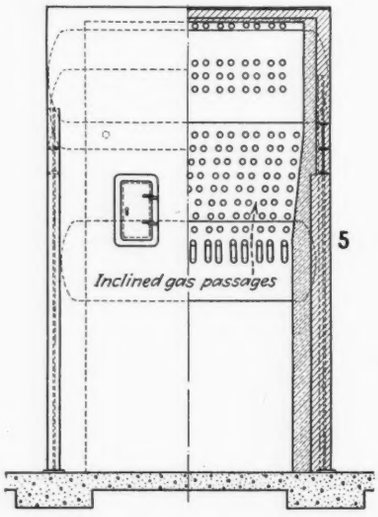

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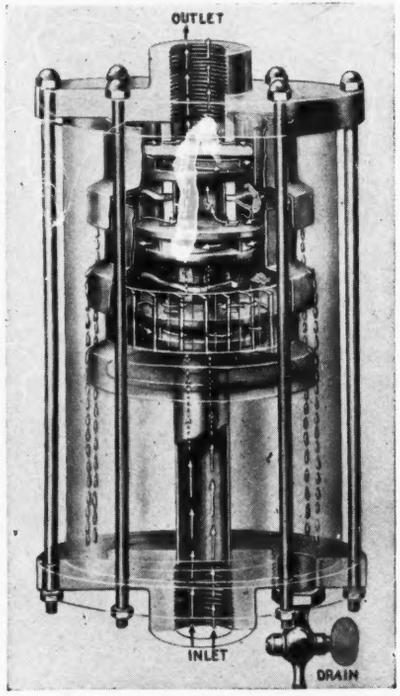


1 WEIGH COAL FEEDER—Made up of constant-speed belt conveyor fed by "Vibra-Flow" feeder conveyor. Short-length belt conveyor is driven by constant-speed synchronous motor. Entire belt-conveyor assembly is suspended from a sensitive scale equipped with electric valves actuated by slightest underweight or overweight movement of scale beam. Rate of flow is controlled by varying energy to feeder trough's driving electromagnet, in turn controlled by scale electric valves, which speed up flow when load on belt conveyor gets underweights, and conversely. *Syntron Co, Homer City, Pa.*

2 PROPORTIONING UNITS—Two models, WW and S. First is standard Model B feeder with automatic recharge. Model S, illustrated, is automatic proportioner for continuous introduction of lime and similar suspended chemicals. Agitator in reagent compartment does not emulsify oil. Similar to Model B, except that sight-feed indication is provided to keep reagent tank clear for agitation. Sight feed is indicated by water dropping through oil. *D W Haering & Co, Inc, 3408 Monroe St, Chicago, Ill.*

3 VARIABLE-CAPACITY BURNER — Mechanical-pressure atomizing oil burner said to burn anything from 15 to 1000 lb of oil an hr with same efficiency of atomization, same spray angle, without danger of clogging of tips or atomizers, and with steady even flame at all rates. Design of burner is such that any number of burners can be controlled in battery from single valve. *Todd Combustion Equipment, Inc, 601 W 26th St, New York, N. Y.*

4 WATER HEATER—Horizontal atmospheric water heater is fired by immersion heaters. A small gas flame is burned on inside of each tube, which is surrounded by water to be heated. Unit can be installed on floor or hung to ceiling. Alloy-iron tubes are horizontal, thus permitting lime and mud to settle below bottom. Thermal efficiency of 84%. *Sellers Engrg Co, 2415 N Ashland Ave, Chicago, Ill.*

5 BOILER—Three-drum, water-tube, low-head, bent-tube boiler features spacing tubes along inclined gas passages. Patent is applied for tube arrangement, which exposes all tubes to gas in partial staggered spacing. Manufacturer claims 26% more direct gas wash of tubes, which means greater turbulence and therefore better heat transfer. *Page Boiler Co, Chicago.*

6 CO_2 INDICATOR—Pocket indicator, complete with carrying case and accessories, weighs less than 3 lb. Gas sample is pumped in with a dozen strokes of aspirator bulb while plunger is held down. Reading is taken from mercury column after absorbing unit has been raised and lowered. *F W Dwyer Mfg Co, 565 W Washington Blvd, Chicago, Ill.*

7 STOKER—No. 15 stoker is designed to burn a variety of bituminous stoker coals, and will handle 3500 sq ft of radiation. Hopper is enclosed; front compartment houses fan, motor, transmission and automatic air control. Transmission shear pin has a "Load Signal," which announces when the pin shears, should an obstruction get into feed tube. Burning head has laminated tuyeres with primary and secondary air ports. Flexibility to meet local boiler conditions secured by varying length of tuyeres. *Link-Belt Co, 307 N Michigan Ave, Chicago, Ill.*

8 CENTRIFUGAL SEPARATOR—For cleaning and drying of compressed air, gas or

steam. Mounted one above the other are three internal vaned units through which air, gas or steam must travel in succession before it can issue at top connection. Each of these units sets up rapid whirling movement as long as there is passage through separator. Whirling throws moisture and dirt outward from center. At same time, flow is caught by additional sets of vanes curved in opposite direction and secured to overlapping sleeves inside housing. Reversal following centrifugal action causes moisture and dirt to strike inner surface of cups, from where they drop to a collection chamber. For pipe sizes to ¾ in. *Textite Corp, 2110 Roscoe St, Chicago, Ill.*

9 BLOWDOWN SYSTEM—Unit blowdown system combines flash tank mounted on heat exchanger with automatic control of blowdown flashing into tank. Blowdown is proportioned to makeup, keeping boiler water at constant predetermined concentration. Unit comes complete with only piping connections to be made on job. *Henszey Co, Watertown, Wis.*

10 STEAM-JET EJECTORS—Single-, 2-, and 3-stage steam-jet ejectors are able to handle any quantity of wet or dry mixtures at any vacuum and have high efficiency. Manufacturer claims simplified design using only 3 principal parts: 1-piece steam nozzle, streamlined suction chamber and sturdy 1-piece diffusor. *Ingersoll-Rand Co, 11 Broadway, New York, N. Y.*

11 CONTINUOUS BLOWDOWN—Is based on an initial pressure drop ahead of a special steel blowdown valve. Pressure is reduced by fixed "Anum-metal" orifice that determines maximum flow. This results in a proportionate volume increase, due to reflash, Accuracy of control through blowdown valve is multiplied in same ratio that volume has been increased. Further regulation is by special restricted seat and position indicator of blowdown valve. Standard valves furnished for pressures to 650 lb or temperatures to 800 F. *Strong, Carlisle & Hammond Co, Cleveland, Ohio.*

12 COAL METERS—"Lea" coal meters made in two types: One, illustrated, operated by an endless chain, is for vertical coal pipes. One strand of chain runs inside of pipe and moves down with coal flow. Movement of chain drives coal meter through sprocket and gears. With other type, coal is delivered from a receiving hopper onto a feeder conveyor or chain-grate stoker. Spiral-toothed gear on meter, driven by stoker, meshes with counting wheel mounted rigidly on a draw bar connected to coal gate. Counting gear meshes with a long gear that drives coal meter. When fuel gate is fully open, counting wheel meshes continuously with spiral-toothed drum to give maximum registration on meter for given stoker speed. As coal gate is closed, counting wheel moves to left and is in mesh with spiral-toothed gear for decreasing periods until gate reaches minimum-feed position. *Factory Equipment Co, Ltd, 107 Front St, Toronto, Ontario.*

13 DESUPERHEATER—Introduces steam jet to atomize cooling water so that mist is introduced into steam pipe. Both cooling water and steam are controlled by two single-seat, parabolic-disk valves, in turn controlled by temperature pilot. As temperature increases, pilot releases pressure from control valve diaphragms, allowing them to gradually open, supplying correct mixture of water and steam. To use this unit, it is necessary to reduce before desuperheating, or supply steam for atomizing purposes, at higher pressure than that in main pipe. Otherwise, a mechanical-atomizing nozzle must be used. *Spence Engineering Co, Inc, Walden, N. Y.*

14 EXCHANGER & COOLER—Has narrow flat passageways for both liquids. No gasketed joints to permit leakage between fluids. All passageways or transfer surfaces are accessible for cleaning by removing two heads, are streamlined to reduce turbulence and friction losses, and are very thin, causing intimate contact between all particles of liquid and heat-transfer surface. *Condenser Service & Engrg Co, 310 12th St, Hoboken, N. J.*

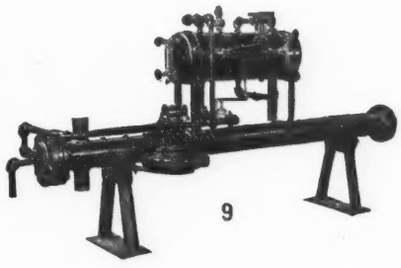
BOILER-WATER TREATMENT — Recently formed American corporation markets "K.A.T.," a colloidal boiler compound used past few years in France and other European countries. It is claimed that K.A.T. will prevent scale formation and cause disintegration of existing scale coatings. *American K.A.T. Corp, 122 E 42nd St, New York, N. Y.*

SMOKE-DENSITY INDICATOR — "Photoswitch" smoke ontrol, Type A2OC, indicates when smoke passing through furnace flues exceeds a predetermined density. Photoswitch control and light source are mounted on opposite sides of flue or chimney on rigid brackets. Light beam projected by light sources looks through a small opening in flue, across inside of flue, through a second opening to control eye. Bell or signal light, at any convenient location, is wired to terminal block inside control housing. *Photoswitch, Inc, 21 Chestnut St, Cambridge, Mass.*

REFRACTORIES—Two products, "Coprtex" block and heat-insulating cement, are designed for high temperatures. Features of block are: low lineal shrinkage, high insulating efficiency, high modulus of rupture, accommodation of rivet heads and similar projections, and availability in special as well as standard shapes. Cement has much same characteristics. *Armstrong Cork Co, Lancaster, Pa.*

AUTOMATIC PROPORTIONER—For automatically proportioning liquid and dry chemical reagents to an untreated fluid, this arrangement consists of a "chronoflo" meter and venturi tube or orifice in main fluid line, controlling rate of feeding by electric signal. For liquid chemicals, this is done by positive displacement pumps, and for dry chemicals, by a vibratory dry feeder. Flow of main-line fluid through a venturi tube produces a difference in elevation in levels of liquid in float pipes, one float pipe being connected to venturi-tube inlet and other to venturi throat. Floats actuate Chronoflo differential transmitter which sends out electric time-impulse signals. *Proportioneers, Inc, 9 Codding St, Providence, R.I.*

REFRACTORY INSULATING CONCRETE—Three materials for making lightweight concrete for refractory insulation include B&W Light-Weight Aggregate, to which both cement and water must be added to form concrete, and two premixed materials—B&W K-20 and B&W K-22 Concrete Mixes. K-20 is suitable for 2000 F, and K-22, for 2200 F. Lightweight aggregate can be mixed with Portland cement, a high early-strength or high alumina cement to obtain concretes of varying characteristics for temperatures from 2000 to 2200 F. *Babcock & Wilcox Co, 85 Liberty St, New York, N.Y.*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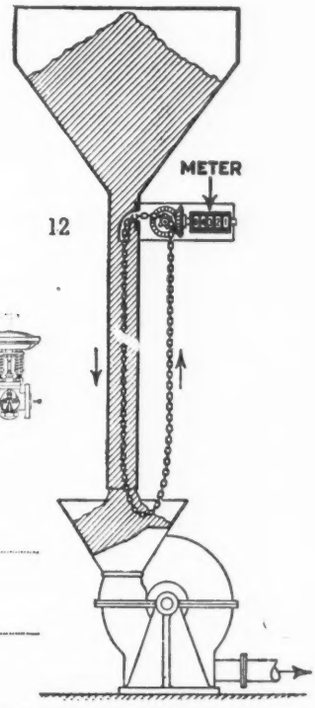

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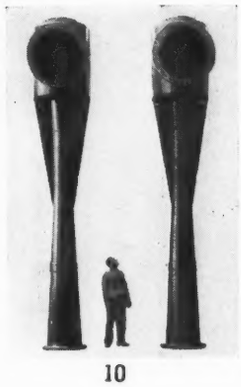
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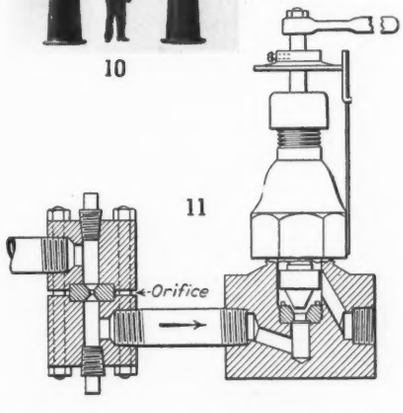

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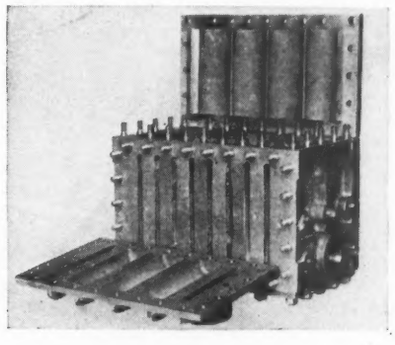
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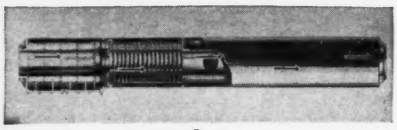
DIESELS, GAS ENGINES AND ACCESSORIES



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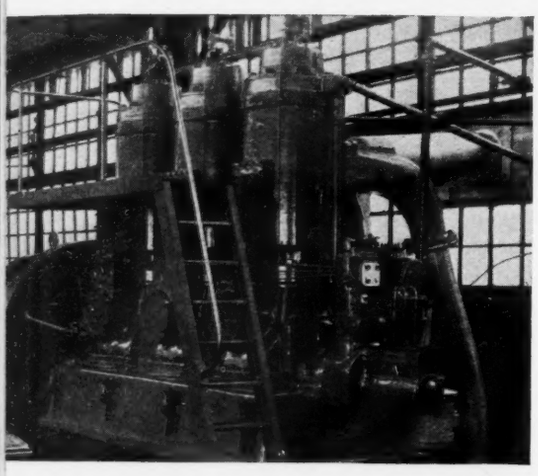

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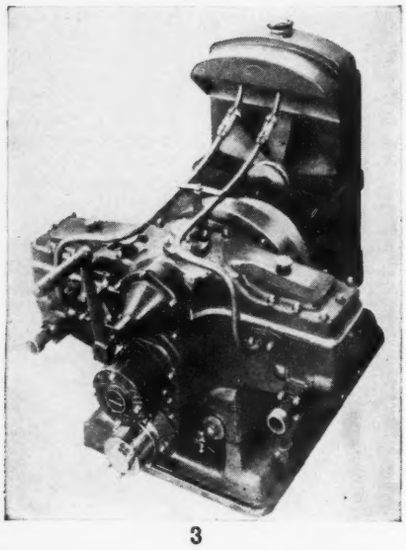

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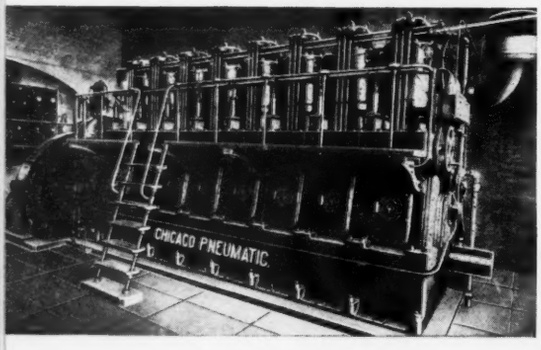

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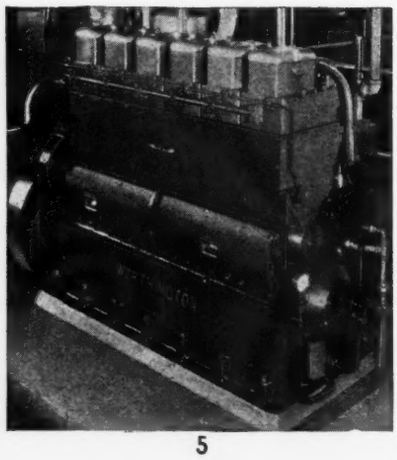

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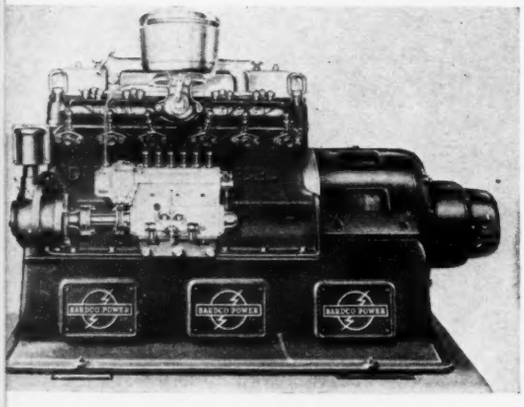

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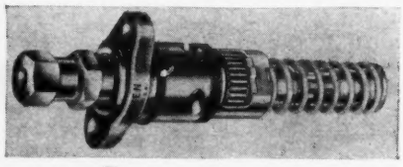

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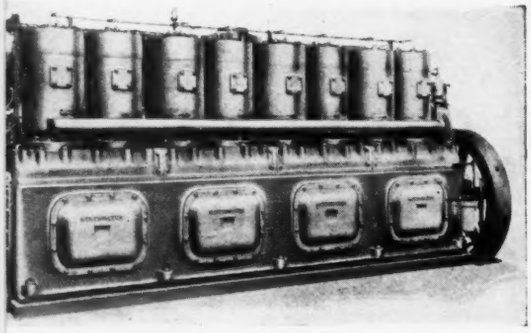

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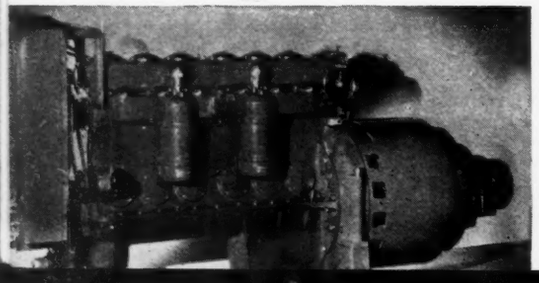

1 INDUSTRIAL MUFFLER — RMF Series muffler, for internal-combustion engines, blowers and compressors, has 60% more silencing volume than standard Burgess heavy-duty muffler. Patented accoustic lining permits straight-through construction. Extra-heavy-gage sheet steel withstands corrosive action of gas. Drain holes at both ends remove condensate, oil and sludge. *Burgess Battery Co, Acoustic Div, 111 W Monroe St, Chicago, Ill.*

2 DIESEL—Type VC, 2-cycle, solid-injection diesel is built in sizes of 55 to 400 hp. Features include: Bosch fuel-injection pumps and nozzles, injection pump cams driven direct from engine crankshaft, injection cam rollers with needle-type roller bearings, automatic lubrication, and hand speed-control synchronizer. *Ball-Muncie Engine Co, Muncie, Ind.*

3 DIESEL—Covic, opposed-cylinder, 4-cycle, valve-in-head, 3 5/32-in. bore, 3 5/16-in. stroke diesel is rated 15-18 hp. Water and lube-oil pumps are mounted on same shaft, driven from crankshaft. Fuel pumps and fuel injectors are Bosch. Made in complete range of models for direct power takeoff, drives for main line shafts, etc. *Northill Co, Inc, Los Angeles, Calif.*

4 HEAVY-DUTY DIESEL — Type RHB-100, vertical, 4-cycle, solid-injection diesel is built in sizes 300 to 800 hp. Trunk-type pistons, Bosch injection nozzles and individual fuel pumps for each cylinder; heat-treated, die-pressed forged-steel crankshaft machined at all bearings to secure uniform balancing and drilled for pressure lubrication; removable cylinder liners cast of special nickel iron. *Chicago Pneumatic Tool Co, 6 E 44th St, New York.*

5 GAS ENGINE—Vertical, 4-cycle, Type AG gas engine developed as heavy-duty, moderate speed, small unit. Valve-in-head construction, total enclosure of all moving parts, removable cylinder liners, separate water-cooled cylinder heads, lightweight oil-tight covers for crankcase accessibility, and force-feed lubrication. *Worthington Pump & Machinery Corp, Harrison, N. J.*

6 GENERATING UNIT—Compact automatic diesel-powered generating plant is designed to meet requirements of any desired voltage or frequency. Regulation maintains constant voltage irrespective of load demands. Safety controls, which can be set at any predetermined point, give warning signal in case of overheating or low oil supply, and stop engine before damage occurs. *Bardco Corp of America, 6670 Lexington Ave, Los Angeles, Calif.*

7 FUEL-INJECTION UNITS — Renewable pumping units for Timken fuel-injection pumps are pre-metered at factory. Comprise a rigid, simple unit—body, barrel and plunger, delivery valve and delivery-valve spring. Unit is held tightly in injection-pump housing by two hexagon nuts threaded on two studs in pump housing, pressing against a flange on upper end of pumping-unit body. Pumping unit is aligned axially in housing by close fit in housing bore and by reason of unit flange holes being accurately slotted to bear tightly on two sides of one dowel stud. *Timken Roller Bearing Co, Canton, Ohio.*

8 GAS ENGINE—Type LPE, vertical, 4-cycle engine is of multi-cylinder, trunk-piston type with L-head cylinders arranged in line. Totally enclosed with pressure lubrication throughout. Straight-line arrangement of cylinders gives accessibility and permits equal intervals between power impulses. Made in 4-, 6- and 8-cyl units, rated 180, 270 and 360 hp, at 400 rpm. *Worthington Pump & Machinery Corp, Harrison, N. J.*

9 OIL RECLAIMER—"Hilco" oil-reclaiming units are made in three models for direct

connection to lubricating systems of stationary and marine diesels. May be used as batch reclaimers where operator prefers to drain lubricating system and deliver oil to dirty-oil receiving tank, from which the Hilco draws its supply. Filtering agent is a Fuller's earth, which is said to remove all carbon, sludge, resins, gums, acidity and restore color by adsorption. *Hilliard Corp, 4 W 4th St, Elmira, N. Y.*

10 GENERATOR SETS—Made in two sizes, one with 4-cyl engine delivering 45-55 kw, and the other with 6-cyl engine delivering 65-85 kw. Can be supplied complete with generator built into flywheel housing or separate and driven through flexible coupling. Engines are recently developed solid-injection units. Starting is on gasoline; handwheel permits switching over to fuel oil. *Murphy Diesel Co, Ltd, Milwaukee, Wis.*

11 OIL FILTER—Improved pressure oil filter, similar to Type 4L, has eight closely woven textile filter-bag elements wound around a central spool. Liquid filters through bags from inside out. Bags may be thrown away with dirt inside them, or reversed and cleaned. Automatic bypass and relief valve in bag spool will relieve pressure if bags clog. Range of operating pressures is 1 to 100 lb. *Wm W Nugent & Co, 410 N Hermitage Ave, Chicago, Ill.*

12 PISTON RING—One-piece ring is made of resilient corrugated metal strip bent into a circle. Plastic material, molded into body metal, acts as filler, completely filling piston-ring groove. Filler and body form a solid integral open band which is wrapped around piston-ring groove. Varying alloy of metal, or number of corrugations per in., or metal thickness, makes possible any wall tension. *Elk Machine & Tool Works, 109 W 64th St, New York, N.Y.*

13 AIR CLEANER—"Cycoil" oil-bath air cleaner designed for protection of engines and compressors subjected to extremely heavy dust concentrations. Effectiveness of unit is attributed to fact that it precleans compressed air—frees it of most of entrained dust and oil before air reaches filter cell. Filter cell of crimped wire does not require frequent cleaning because of air precleaning. Made in sizes 250 to 4000 cfm. *American Air Filter Co, Inc, 1st & Central Ave, Louisville, Ky.*

14 DIESEL-DRIVEN COMPRESSOR—Right-angle, 2-cycle, solid-injection, diesel-driven compressor is built in 2-, 3-, 4-, 5- and 6-cyl sizes (150-, 225-, 330-, 375- and 450- hp). Each diesel power cylinder has 13-in. bore, 14-in. stroke and normal rated speed of 300 rpm. All power cylinders are vertical and at 90 deg to compressor cylinders. *Clark Bros Co, Olean, N.Y.*

15 MUFFLER — ATP-Series spark-arresting muffler removes carbon particles and sparks from exhaust gas. 3-pass construction; exhaust gas enters from below, is diverted downward, then upward, and out. Carbon particles are separated as gas changes direction. Reactance chambers at inlet and outlet ends suppress low-pitched noises while high-pitched noises are dissipated in spark-arresting chamber. *Burgess Battery Co, Acoustic Div, 111 W Monroe St, Chicago, Ill.*

16 PRESSURE INDICATOR—"Premax" indicator for measuring peak pressure in internal-combustion engines or other machines in which pressures occur in successive cycles of same form. To make measurement, rotate vulcanite ring nut below scales until neon light stops flickering. This indicates that spring tension is just sufficient to balance maximum cylinder pressure, which can be read off directly from scales. Standard model reads up to 1200 lb per sq in. *Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh, Pa.*

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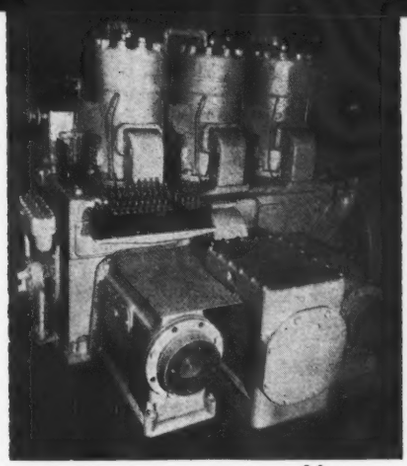

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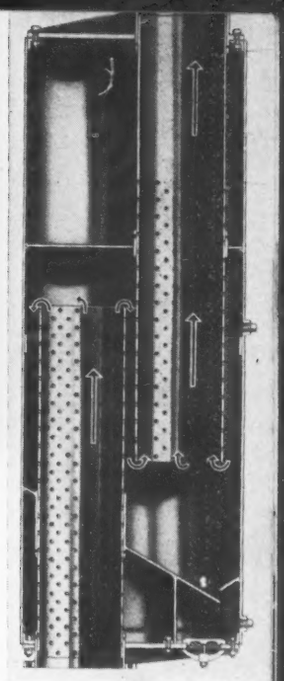

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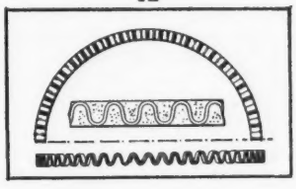

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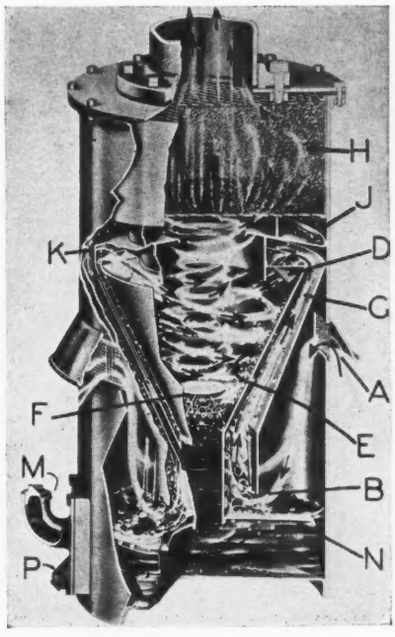

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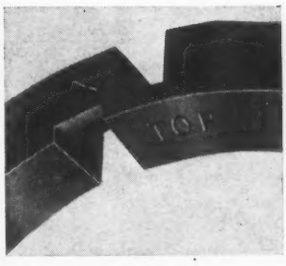

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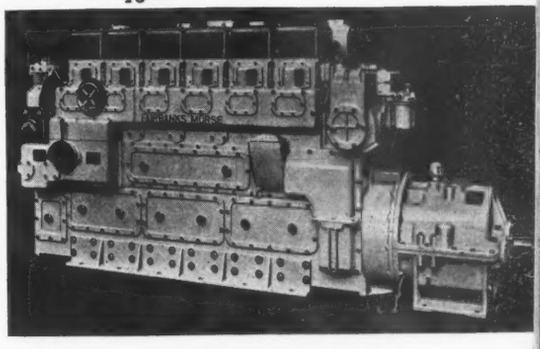
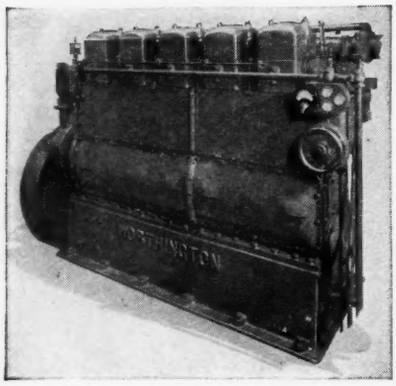


17 PISTON RINGS—"Seal Cut" Pedrick piston rings have specially designed lap fit to prevent leakage past ring. Heat shaping said to insure equal distribution of radial pressure throughout circumference of ring and to provide a black iron-oxide protective coating. *Wilkening Mfg Co, Philadelphia, Pa.*

18 INDICATOR VALVE—For connecting indicator (item 16) to engine, this valve has been improved in design and materials. Body is chrome-iron forging and spindle is stainless steel. When main passage is closed, indicator connects to atmosphere through a vent beside stem communicating to hole in side of valve bonnet. Vent prevents hot gas from passing through stem threads. *Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh, Pa.*

19 CONVERTIBLE ENGINE—Model 36-A-8 convertible gas and diesel engine built in 6- and 8-cyl combinations with 8-in. bore and 10½-in. stroke to develop 35 hp per cyl at 720 rpm. Enbloc construction with individual cylinder liners; precision main, connecting-rod and crankshaft bearings; and suspended or "underslung" crankshaft. Side coverplates permit quick accessibility to bearings. *Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago.*

CRANK CASE CLEANER—Method for cleaning diesel crank cases utilizes an oil-soluble emulsifier. In solution with kerosene or light fuel oil, mixture is sprayed on crank-case surfaces and allowed a 1- to 3-hr soak. After being thoroughly loosened and softened, grease and other accumulations are flushed away. *Oakite Products, Inc, New York, N.Y.*



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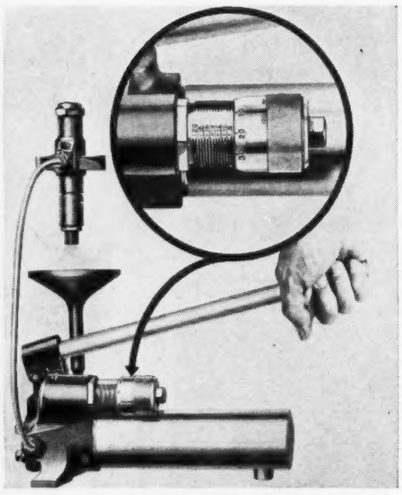

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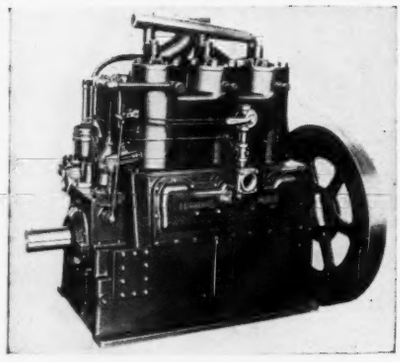


1 DIESEL—Type BB vertical direct-injection Diesel developed for continuous heavy-duty loads and as peak-load unit for larger plants having other prime movers. Construction makes this engine suitable for rock-products plants, oil-field work, grain mills, etc, where quantities of dust or abrasives may fill the air. *Worthington Pump & Machinery Corp, Harrison, N. J.*

2 NOZZLE TESTER—Diesel injector nozzle tester consists of hydraulic pump element operated by long hand lever. Fuel oil used for testing is contained in horizontal cylinder directly below operating lever, which forms a 1-pint reservoir. Fuel is forced by pump through high-pressure injection tubing and discharged from nozzle into funnel and thence returned to reservoir and recirculated. Balanced bypass valve connects delivery passages drilled in malleable-iron pump head with return port leading to oil reservoir. By controlling spring tension on this bypass valve, pressure in nozzle line may be adjusted for any required nozzle setting by knurled micrometer head. One revolution changes discharge pressure 100 lb; graduations permit settings to 5 lb. *Waukesha Motor Co, Waukesha, Wis.*

3 CONVERTIBLE ENGINE—Model 34-AC-6 convertible oil and gas engine is 2-cycle, vertical, 2- or 3-cyl. Speed, ranging from 300 to 850 rpm, is governor controlled. Furnished with either standard or reverse rotation and with power takeoff on either end. Principal parts are interchangeable. *Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago, Ill.*

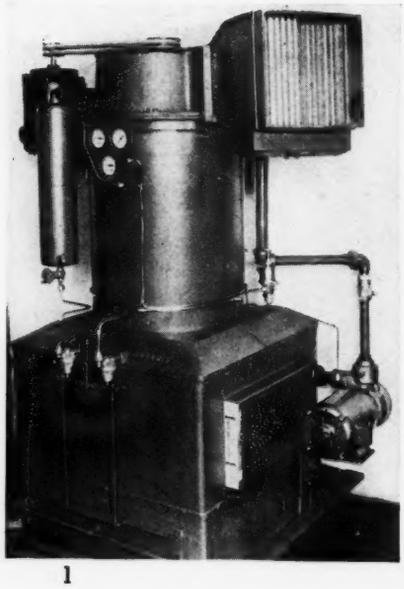
IGNITION LAG INDICATOR—This instrument determines ignition quality (cetane number) of diesel fuels. Inherent accuracy is said to be greater than ¼ cetane number. Fuel is injected at a given time before top center, and compression ratio is adjusted to give ignition at top center, as measured by indicator. Fuel of unknown quality is bracketed between two known fuels. Magnetic pickups detect injection and ignition impulses, a double thyratron relay converts impulses into short-lived surges of electricity, and a neon projector converts impulses into visual signal. *American Instrument Co, Silver Springs, Md.*

HEATING, VENTILATING, REFRIGERATION AND AIR CONDITIONING

1 EVAPORATIVE CONDENSER—This unit designed for methyl chloride or Freon-12 (but can be furnished for other refrigerant vapors on application). Uses water cooling produced by evaporation of water on warm wetted surface. Water vapor is carried away by air current from built-in blower. Unit is constructed of heavy-gage sheet steel and has multiple vertical tubes. Water is drawn from lower pan to condenser top where a film of water flows by gravity down inside walls of tubes. Air is drawn by blower through filters and up through filters in direction opposite to water flow. Saturated air is discharged over an eliminator core, removing free water which is returned to pan. Refrigerant is condensed on outside of tube and water is evaporated on inside. Water evaporation is approximately 1½ gal. per hr per ton of refrigeration. *Curtis Refrigerating Machine Co, St. Louis, Mo.*

2 AIR FILTER—Throwaway filter cleans air as it impinges against layers of expanded fibre. Layers have been sprayed with a sticky compound that retains dust and pollen. Three sections—coarse, medium and fine mesh—make up complete filter. Each section consists of 7 layers of expanded fibre. Efficiency ranges from 86% on up, depending on dust size. When filter is new, resistance to air flow at 250 fpm is 0.01 in. of water. *C F Burgess Laboratories, Inc, 110 W Monroe St, Chicago, Ill.*

3 PORTABLE CONDITIONER—Model BA-90 "Yorkaire" freon unit has adjustable rotary grille which diffuses conditioned air through room. Outside air is introduced through adjustable damper. Both outside air and recirculated air are blended and passed through a special filter. Rapid room-air exhaust makes passible quick and thorough replacing of entire volume of air in room. Window adapter, ad-



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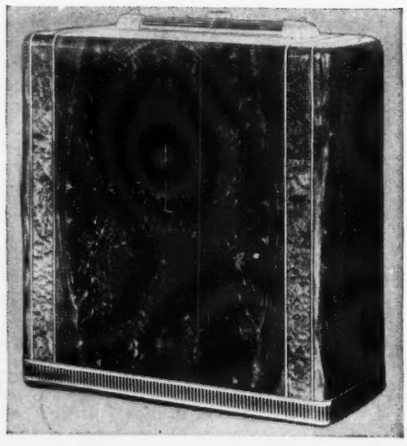

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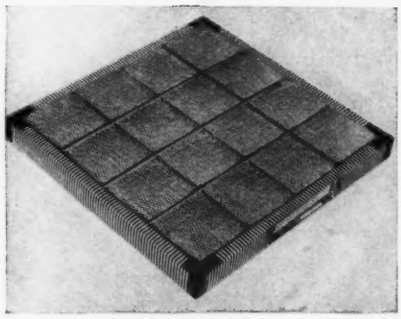

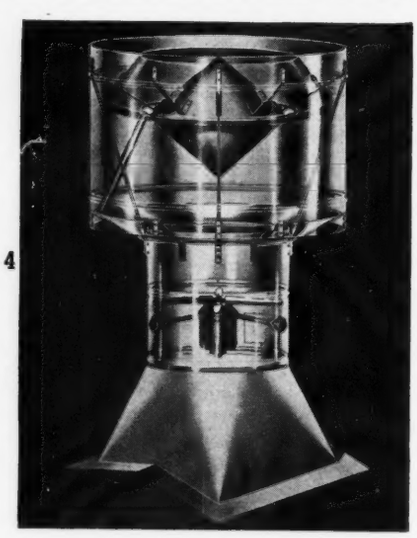

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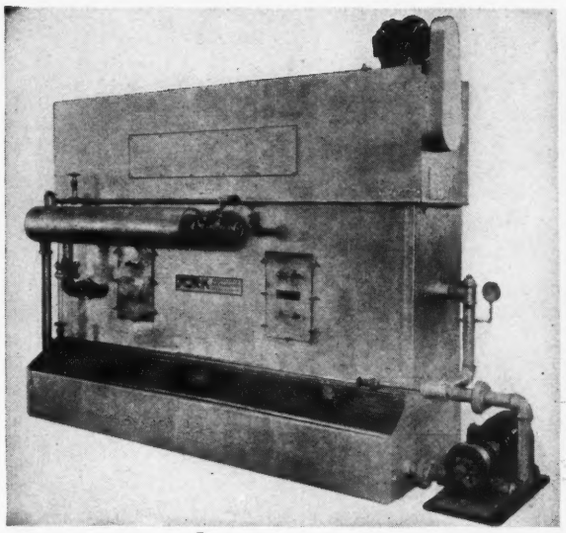

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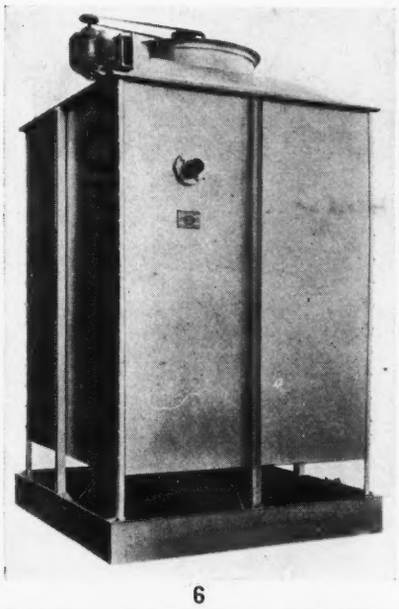

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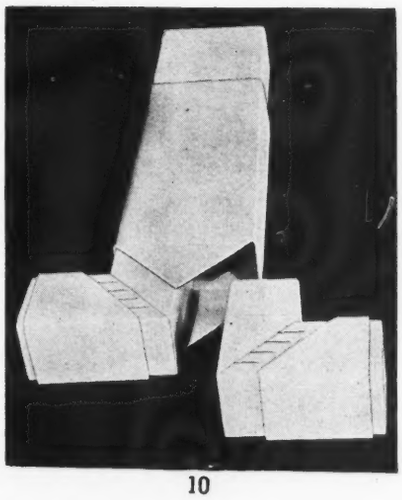

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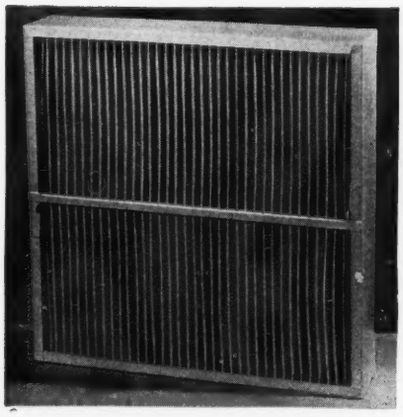

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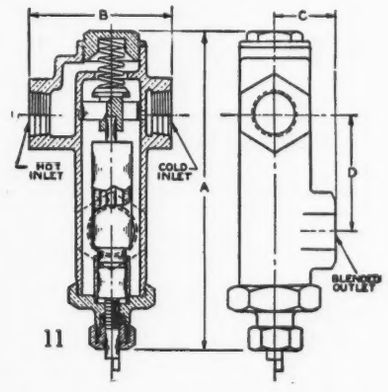

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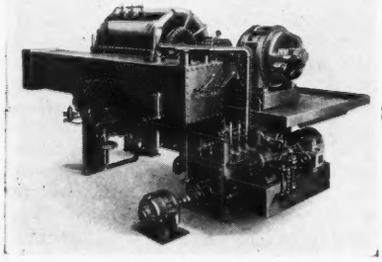

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justable to window size, contains fresh-air inlet, condenser-air intake, and condenser-air exhaust connections. *York Ice Machinery Corp, York, Pa.*

4 FAN VENTILATOR—"Free-Flow" ventilator made in three parts: base, head and fan barrel. Base and head are same as furnished in gravity ventilator with exception of additional stiffening in bases of larger sizes to support added weight of fan assembly. Fan barrel consists of section of round airshafting of sufficient length to house motor mounting, motor and fan. Inspection doors on all fan barrels provide easy access to greasing connections. Special heat- and acid-resisting models for air temperatures over 105 F. *Burt Mfg Co, Akron, Ohio.*

5 CONDITIONER—FS-12000, spray-type air conditioner, for industrial low-temperature applications, handles air volumes up to 16,000 cfm and capacities up to 40 tons refrigeration. Front, back or top discharge outlets can be provided and spray-water heaters and air-reheat coils are available. Unit supplements standard line of York conditioners for constant temperature and relative humidity. *York Ice Machinery Corp, York, Pa.*

6 COOLING TOWERS—Addition to line of water-cooling equipment is a series of small steel-cased induced-draft cooling towers, including horizontal wood-filled types for indoors and vertical wood-filled or spray-filled types for outdoors. Horizontal indoor towers have 16-gage copper-bearing-steel casings and basins. Zig-zag drift eliminators of heart redwood and cast-iron spacers are built as one unit, easily lifted out for access to tower interior. Vertical outdoor towers have multiple-effect drift eliminators of heart redwood with cast-iron spacers and fans V-belt driven from motors on tower roofs. *The Marley Co, 3001 Fairfax Rd, Kansas City, Kan.*

7 AIR FILTER—"Wire-Klad" air filter has wire-mesh reinforcing filtering medium so that filter can be cleaned indefinitely by high-pressure air or vacuum. Several kinds of filtering media to suit varying conditions are available, most usual being cotton or a wool felt-like material known as "Feltex". Three standard depths: 2, 4 and 6 in., and four standard sizes: 20 x 20, 16 x 20, 16 x 35, and 20 x 25 in. *Staynew Filter Corp, Rochester, N.Y.*

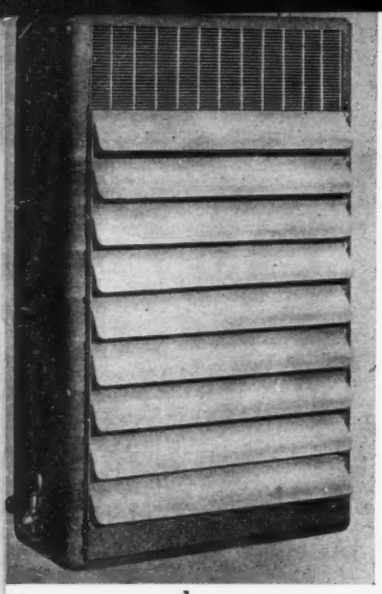
8 REFRIGERATING MACHINE—Centrifugal water-vapor refrigerating units provide sustained capacity, self regulation and high reserve capacity for cooling water for air conditioning, industrial and chemical plants. Can be driven by either turbine or motor. Bulletin 9144. *Ingersoll-Rand Co, 11 Broadway, New York, N.Y.*

9 AIR FILTER—"Wire-Klad" air filter has aged air conditioner made in 3- and 5-ton sizes. Water-cooled units require three connections for installation. 3-ton unit delivers 1100 cfm of air and 5-ton unit, 1460. Dynamically balanced compressor; controlled mixture of outside and room air by large-area return grille with adjustable louvres; and non-clogging refrigerant strainer. *Carrier Corp, Syracuse, N.Y.*

10 AIR-CONDITIONING DUCT — "Carey-duct" is made in standard double-layer sections 3 ft long. Each section consists of an inner asbestos layer or core approximately 3/16-in. thick. Outer shell or insulating jacket, made of multiple layers of fine corrugated, firmly bonded asbestos, makes close sliding fit over inner core. Total wall thickness of core and jacket combined can be made from ½ in. up to suit conditions. *Philip Carey Co, Lockland, Cincinnati, O.*

11 WATER BLENDER—Three-way thermostatic valve, operating on liquid-expansion principle, has four ports, two for each inlet. It is piston type, with all four valve seats exactly same diameter. Relief spring prevents damage to thermostat from over expansion. Over-heating up to 50 deg beyond calibrated temperature not injurious. Standard Type DB blender has range of 140 to 180 F. *Sarco Co, Inc, 183 Madison Ave, New York, N.Y.*

DEFROSTING METHOD — "Kilfrost," a paste, applied to pipes of brine and ammonia systems, said to make removal of frost and ice easy. Where present method of defrosting is "snow banging," defrosting is carried on in ordinary way and pipes painted with Kilfrost. Then when pipes are next defrosted, growth will be soft and will tap or pull off, leaving clean pipes. Can also be used where chambers are defrosted by other means. *Refrigerating Utilities Co, 370 Lexington Ave, New York, N. Y.*



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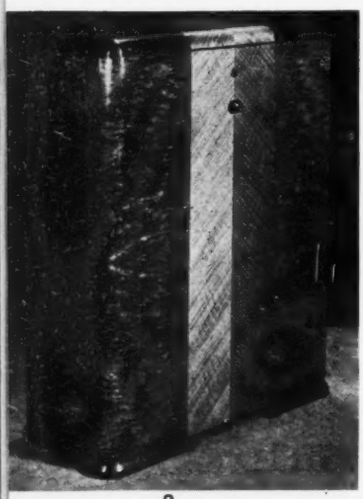

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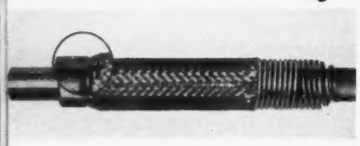

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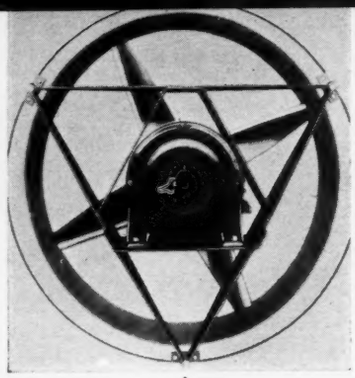

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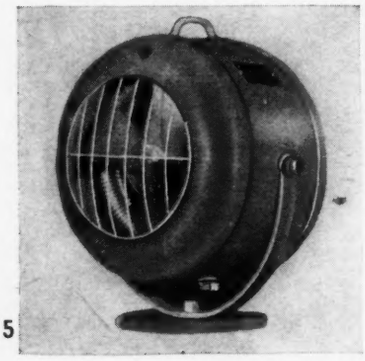

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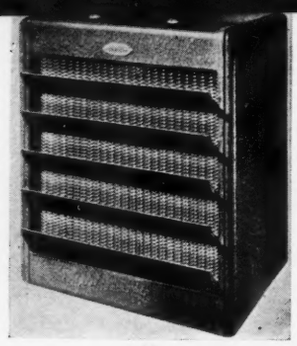

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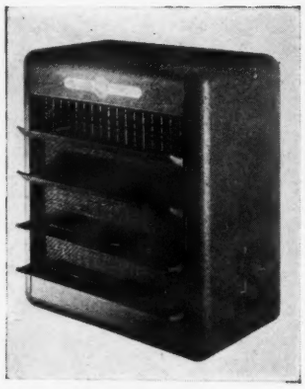

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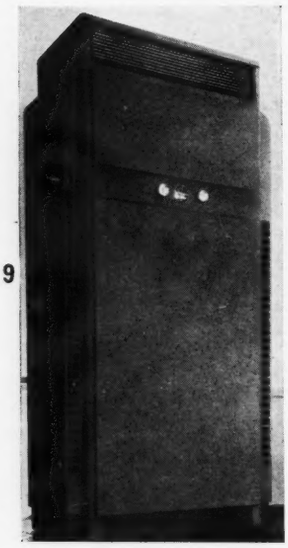

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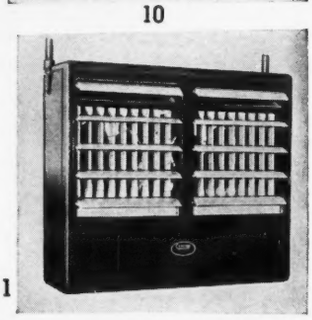

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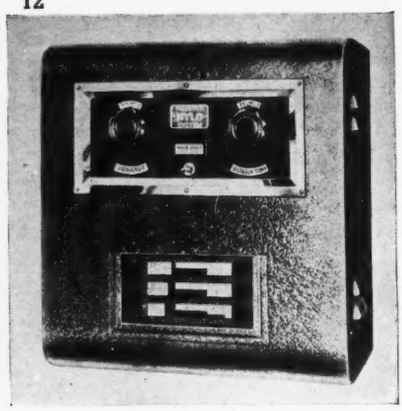

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1 UNIT HEATER—Starting fan motor closes electric circuit which operates solenoid gas valve to open gas burner wide and supply heat to unit. Current failure or overload shuts off current and gas valve simultaneously. Heater is vented to take off products of combustion. Fan and motor, mounted at rear, pass stream of air through heating element. Adjustable aluminum louvres. *Resnor Mfg Co, Thompson St, Mercer, Pa.*

2 AIR CLEANER — Self-contained, portable, electrostatic air cleaner has been designed especially for relief of hay-fever and pollen-asthma sufferers, but is also applicable to general air cleaning. Operates from standard 115-volt outlet and circulates 240 cfm of air. Unit depends for its operation upon cleaning action on gases of a corona discharge. Dirt particles and foreign matter in air are charged in an ionizing section and then precipitated on charged plates of dirt-collector cell. Collector cell is washed out about once in six weeks. *Westingbouse Elect & Mfg Co, E Pittsburgh.*

3 VIBRATION ABSORBER—This device, although developed for refrigeration and air-conditioning lines, can be adapted to general industrial use. Made from seamless bronze tubing drawn into a helical flexible tube, by a process that permits using tubing of extra wall thickness and strength without sacrificing strength. Straight-end extensions are provided to slip over standard piping or to make up to standard fittings. Range of sizes from ¼-in. ID to 6-in. IF. Working pressures from 1000 to 150 lb. *Packless Metal Products Corp, Long Island City, N.Y.*

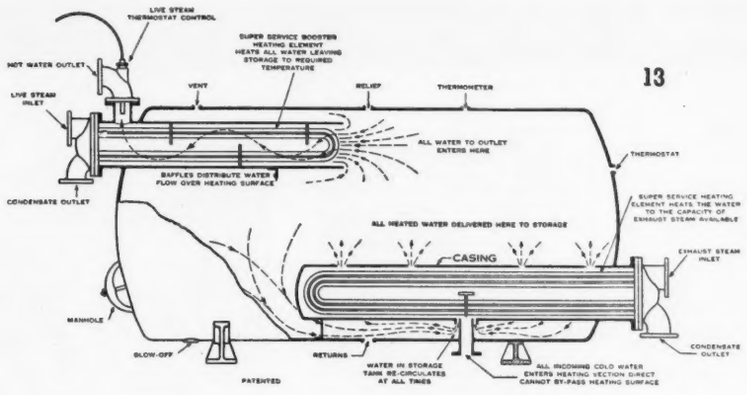
4 VENTILATING FAN—2-, 4- and 6-blade "Dynaflow" fan units in sizes from 16-in. to 36-in. diameter have air deliveries from 1240 to 26,000 cfm. Also, "Aerospot" fans of mobile and portable type in sizes from 20- to 36-in. diameter are effective as man coolers at distances from 50 to 175 ft. Aluminum-alloy drop-forged fan blades, rolled-steel supports for motors. *South Bend Air Products Inc, 322 E Colfax Ave, South Bend, Ind.*

5 INDUSTRIAL HEATERS — Forced-convection heater made in three sizes: small portable in ratings of 2, 3 and 4 kw; intermediate size, suspension style, in ratings of 5 and 7½ kw; and suspension heater in ratings of 10, 12½ and 15 kw. 230 volts, 60 cycles—small and intermediate sizes are single-phase; large sizes, 3-phase. Calrod heating units are brazed to radiating fins. Totally enclosed motor has sleeve bearings and baffle plate to protect it from overheating. *General Electric Co, Schenectady, N.Y.*

6 ROOF VENTILATOR—Fan roof ventilator uses standard Type L fan with non-overloading power characteristic. Totally enclosed ball-bearing motor designed for vertical operation. Fan ring and motor are mounted on vibration dampers. Made in sizes ranging from 14- to 48-in. fan diameter. *American Machine & Metals, Inc, De Bothezat Ventilating Equipt Div, 100 6th Ave, New York, N.Y.*

7 UNIT HEATER—Series 4 unit heaters made in 25 models ranging in capacities from 75 to 1200 sq ft. Included in improvements are new heating elements with double headers, providing free steam passage; new manifolds and improved full-floating mountings for eliminating expansion stresses and maintaining alignment between element and cabinet. *Fedders Mfg Co, Buffalo, N.Y.*

8 UNIT HEATER—Propeller-fan "HiJet" heater made in 18 sizes for steam or hot water to handle air capacities of 275 to 5060 cfm. Heating element has loops to absorb difference in expansion and contraction between individual tubes. Entire tube and loop is fabricated of red brass. Patented spray tube maintains proper relationship between heater headers. Louvres are adjustable and curved to direct heat downward. *Herman Nelson Corp, Moline, Ill.*


LIVE STEAM THERMOSTAT CONTROL
SUPER SERVICE BOOSTER HEATING ELEMENT HEATS ALL WATER LEAVING STORAGE TO REQUIRED TEMPERATURE
HOT WATER OUTLET
LIVE STEAM INLET
VENT
RELIEF
THERMOMETER
ALL WATER TO OUTLET ENTERS HERE
THERMOSTAT
BAFFLES DISTRIBUTE WATER FLOW OVER HEATING SURFACE
CONDENSATE OUTLET
SUPER SERVICE HEATING ELEMENT HEATS THE WATER TO THE CAPACITY OF EXHAUST STEAM AVAILABLE
ALL HEATED WATER DELIVERED HERE TO STORAGE
CASING
EXHAUST STEAM INLET
MANHOLE
BLOW-OFF
RETURNS
CONDENSATE OUTLET
WATER IN STORAGE TANK RE-CIRCULATES AT ALL TIMES
ALL INCOMING COLD WATER ENTERS HEATING SECTION DIRECT CANNOT BY-PASS HEATING SURFACE
PATENTED
13

9 UNIT CONDITIONER—Packaged "Yorkaire" air conditioner needs only three installation connections. Refrigerating unit is cushion-mounted. Air-circulating fan and motor are also cushioned and isolated, and entire casing is acoustically treated. Smaller model needs as little as 21x36 in. of floor space. *York Ice Machinery Corp, York, Pa.*

10 UNIT CONDITIONER—"Unitaire" self-contained unit conditioners made in two sizes with capacities of 2½ and 3¾ hp. Motor, compressor and condenser are hermetically sealed. Adjustable thermostatic control is at center of cabinet. Two switches permit maximum flexibility of operation; one controls entire cooling mechanism, and other the blower motor only. *Westinghouse Elect & Mfg Co, East Pittsburgh, Pa.*

11 UNIT HEATER—Gas-fired unit heater made in three sizes: 1-fan unit of 1300 cfm, 2-fan unit of 2600 cfm, and 3-fan unit of 3900 cfm. Cast-iron combustion chambers and flue collectors, chromium-steel alloy heat-exchanger tubers, aluminum-painted louvres. Ceiling suspended. *Carrier Corp, Syracuse, N.Y.*

12 HEATING CONTROL — "Hylo Steam Variator Control" delivers steam continuonsly to all radiators, keeps them fractionally filled when less heat is desired. By setting dial for prevailing outdoor temperature once or twice a day, operator supplies correct amount of heat to all radiators. Variator dial, when advanced, provides for rapid heating-up. Retarded, it adjusts steam supply for night heating. Can be applied where low-pressure steam, either vapor or vacuum, is circulated through 2-pipe orifice systems. With modifications, can control directly stokers or blowers and motor-operated draft dampers on hand-fired boilers. *Warren Webster & Co, 17th & Federal Sts, Camden, N. J.*

13 STORAGE HEATER — "Super-Service" storage heater provides for complete contact of water and heating surface. Entering water passes directly into bottom of a casing enclosing heater element. Outflow openings at casing top are so proportioned that flow of water before passing to storage is distributed over entire heating surface. Water-inlet at bottom of casing is also proportioned to cause recirculation of storage water at all times, whether it is being drawn or not. *National Pipe Bending Co, New Haven, Conn.*

CARTRIDGE DEHYDRATOR—Although originally designed for air conditioning and refrigeration, this device can also be used for removing moisture from chemicals in solution, and in air drying. Perforated dispersion tube, exposing entire volume of dehydrant to penetration by fluid or air, extends along center axis of dehydrant column. This construction is claimed to reduce pressure drop, prevent channeling and resultant loss in efficiency. Moisture is removed from dryer and cartridge by vacuum. *Henry Valve Co, 1001-19 N Spaulding Ave, Chicago, Ill.*

HOSE, PACKING AND PAINTS

1 SPRAY GUN—"Thor" Model 7E-1 is an improved spray gun for heavy materials. Asphalt paints, sound-deadener materials, etc, will flow out easily through rounded contours from inlet to nozzle. Has variety of nozzle setups, and ¾-in. material inlet opening. *Binks Mfg Co, 3114-40 Carroll Ave, Chicago, Ill.*

2 OILSEAL—"Split-Klozure" oil seal consists of a cut-open, composition sealing element or packing ring, molded into cross-sectional shape resembling a modified V, to which is bonded, under pressure, a finger-type spring. Sealing element and spring are combined into one piece and handled as a single unit. Is dense, non-porous, grainless, resilient, oil-resistant, and can be installed without dismantling machine. —*Garlock Packing Co, Palmyra, N.Y.*

3 GASKET — Spirally wound metal-asbestos gasket retains maximum resiliency for long periods. Ruggedness of "Flexiwound" said to give long life. A general purpose gasket, for all special or standard flanges, boiler-tube caps, manholes, etc. *Azor Corp, Newark, N. J.*

4 LEATHER PACKING—"Bitan" packings made by special tanning process said to give superior tensile strength and resistance to temperature, acids and alkalies. Manufactured as molded cups, U or V packings, flange or hat packings, washers, gaskets or disks. *Garlock Packing Co, Palmyra, N.Y.*

CRAYONS—"Hot-Rite" crayons for marking on hot steel and other metals subjected to high temperature will not melt or run off; yellow and white crayons will withstand as high as 1500 F. Made in five colors. Also "Duramark", a brushless paint in stick form, will mark any surface. After mark is allowed to set, is said to be as permanent and durable as ordinary paint. *Eberhard Faber Pencil Co, 37 Greenpoint Ave, Brooklyn, N.Y.*

PROTECTIVE PAINT—"Metleaf" paint has leafed metallic-lead pigment. For surface protection of wood, metal, galvanized iron and concrete. Is mixed with vehicle, applied by brush or spray gun, and dries to thin sheet of metallic lead. *Densol Paint Co, Rockside Rd, South Park, Ohio.*

ASBESTOS PACKING—Type 72 compressed-asbestos sheet packing is addition to regular line. For temperatures above 212 F where gaskets are in contact with oil or solvent vapors. Is black in color with graphite mixed throughout. *B F Goodrich Co, Akron, Ohio.*

PROTECTIVE SURFACE — For protecting highly-polished, painted, plated or Duco-finished metal surfaces during storage, handling, etc, "Protex" is sprayed or brushed on and then preferably covered with kraft paper. Liquid sets to moisture-proof, coherent, tough skin that is opaque to light and an insulator of low-voltage current. Skin pulls off readily with the paper, or may be pulled off separately in cases when kraft-paper backing can not be conveniently applied. *Haydn F White Co, 415 Newman-Stern Bldg, Cleveland, Ohio.*

AIR HOSE—Has inner tube of gas-oil-proof synthetic rubber, with two or three braids of long-staple cotton cord. Between these are placed sheets of live rubber which vulcanization forces into cord. This construction, with addition of heavy abrasion-resisting cover of black rubber, gives strength. Made in sizes from ½ to 2 in. *Manhattan Rubber Mfg Div, Passaic, N.J.*

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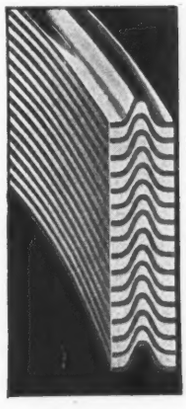
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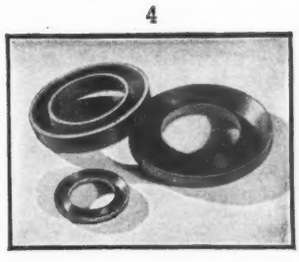
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MECHANICAL TRANSMISSION AND MATERIALS HANDLING

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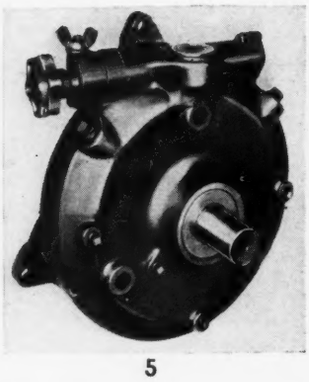

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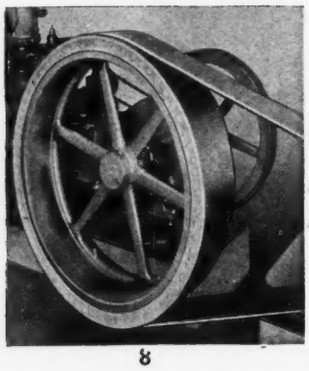

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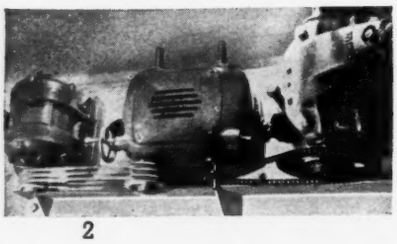

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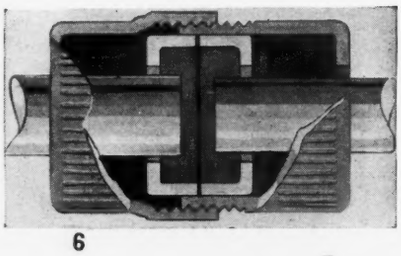

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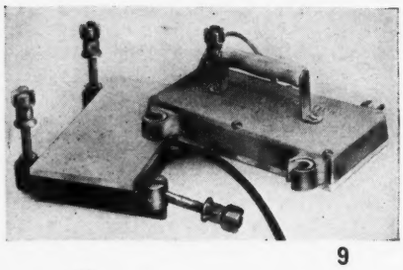

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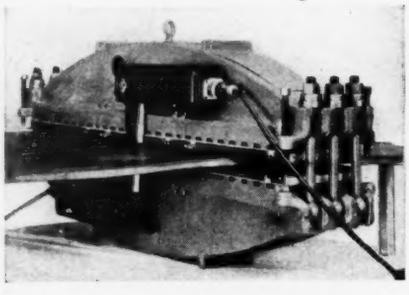

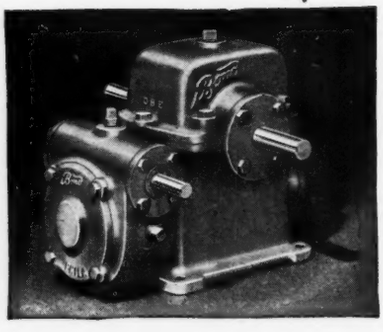

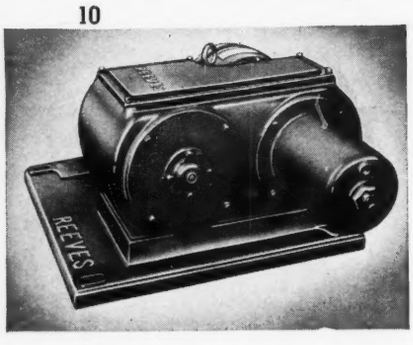

1 VARIABLE-SPEED INDICATOR—"Speedial" indicator, for Reeves variable-speed-control equipment, consists of cast hollow handwheel, metal cup containing an assembly of pinion and gear and brass counterbalance fitting into recessed handwheel, scale with pointer, and transparent cellulose lid. Complete unit is installed or removed as quickly as standard handwheel. *Reeves Pulley Co, Columbus, Ind.*

2 SPEED CHANGER—"Texrope" unit consists of a pair of shafts on which are mounted two grooved vari-pitch sheaves adjusted through a worm-and-worm wheel. Can be operated at high speed, permitting direct-connected motor. This totally enclosed unit, with double-shaft extension and driven from a standard motor, provides flexibility that makes it adaptable to a wide variety of layouts. Where change in speed is to be adjusted manually only, unit has accessible handwheel control. However, it can be equipped with either electric or manual remote control. Made in 7 sizes, covering range of 1 to 33 hp, with speed range of 3.75 to 1, and between 300 and 3600 rpm. *Texrope Div, Allis-Chalmers Mfg Co, Milwaukee, Wis.*

3 BELT VULCANIZER—Light-weight vulcanizer for belts up to 60 in. wide weighs 1650 lb and has total wattage of 5000. Is similar in appearance to Goodrich double-platen, water-cooled type, except that it has only three hinged bolts at each side instead of six. Platens are 65 in. wide and 12 in. long. Can be furnished for either 110 or 220 volts, but no single machine is adaptable for both voltages. *B F Goodrich Co, Akron, Ohio.*

4 VARIABLE-SPEED TRANSMISSION — "Select-O-Speed" transmission gives infinite selection of speeds over 5 to 1 ratio by movement of control lever. Variation of speed ratio is made possible by arrangement of two interlocking sheaves, which may be pivoted laterally by control lever to change driving- and driven-belt tensions. This change automatically causes sheaves to adjust themselves to new pitch diameter for new speed ratio. Sizes to 7½ hp. *Ideal Commutator Dresser Co, 1025 Park Ave, Sycamore, Ill.*

5 VARIABLE-SPEED CONTROL — Control unit governs speed of output shafts through an infinite number of variations through range of unit. With input shaft operating at recommended speed of 180 rpm, variable-speed control can be adjusted by hand set with visible dial to deliver from 1½ rpm to 40 rpm through low-speed shaft. Unit is self-contained and easily installed. It couples to shaft and bolts to machine frame by three bolts. *Morse Chain Co, Ithaca, N.Y.*

6 FLEXIBLE COUPLING—"Torflex" coupling transmits power from driven shaft through rubber bushings that are bound by pressure to shafts. Provides full power transmission, even when shafts are in great angular or parallel misalignment. Made for shaft sizes up to 1½ in. in diameter. *Gordon Engineering Co, 3576 Gratiot Ave, Detroit, Mich.*

7 SPEED REDUCER—Type B double-reduction speed reducers are capable of handling inputs to 2 hp. Ratios as high as 4000 to 1 in both horizontal and vertical types. Worm gears of bronze and worms of hardened steel. All shafts are mounted on bearings and oil seals are used on all shaft openings in housings. *Charles Bond Co, 617 Arch St, Philadelphia.*

8 FIBRE LAGGING—For increasing diameter of pulleys and flywheels, fibre lagging with improved clamp is made of same material as Rockwood paper pulleys. Compressed end-grain fibre-belt surface grips and pulls belt without slip. Made in any width and up to 72 in. in diameter. Is also used in place of pulley coverings where more transmitting capacity is needed, provided 3 to 4 in. increased diameter is not objectionable. *Rockwood Mfg Co, 1801 English Ave, Indianapolis, Ind.*

9 BELTING VULCANIZER—Both upper and lower platens are heated. In operation, upper platen is swung edgewise off from lower one, single permanent bolt acting as axis. Then lapped ends of belt, with cement applied, are laid on lower platen. Upper platen is then swung back into position, and clamping pressure applied by four nuts. Either ac or dc; for either Ton-Tex, fabric or rubber belts. *Ton-Tex Corp, 129 W 22nd St, New York, N.Y.*

10 VARI-SPEED CONTROL—Automatic and remote control for Reeves vari-speed motor drives, known as fluid-pressure control, can be used to regulate automatically speed from

pressure variation, as in stoker feed on a boiler, maintenance of constant fluid pressure in a pipeline or tank upon which there is variable demand, etc. Complete control consists of a bellows-shifting mechanism mounted on a motor drive, and adjustable pressure-reducing valve located where desired, auxiliary valves if needed, and connecting pipes. Speed of shifting depends on fluid used. *Reeves Pulley Co, Columbus, Ind.*

11 ADJUSTABLE-PITCH SHEAVES—Series of 2-groove adjustable-pitch-diameter, Texsteel sheaves give speed variation up to 33%. Pitch diameters are changed by stopping motor, relieving belt tension, releasing Allen-head locking screw and turning adjustable plate in or out to desired pitch diameter. Made in three sizes of 2 to 3 in., 2.5 to 3.5 in., and 3.5 to 4 in. variation respectively. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

12 MATCHING MACHINE FOR V-BELTS Multiple V-belts vary slightly in length, which means that shorter belts will bear brunt of load. Recently developed automatic machine takes belt measurements while belts are running on pulleys under operating tension. Belt is placed over pulleys, which are then mechanically adjusted to provide normal tension. Before pulleys are put in operation, hand on dial registers 50, which represents nominal length of belt, but as soon as machine starts, dial will register less than 50 if belt is short, and over if it is long. *B F Goodrich Co, Akron, Ohio.*

13 GRASSHOPPER DRIVE—Rockwood double-reduction, or grasshopper, drives comprise two pivoted motor bases, a frame holding a ball-bearing-mounted counter shaft and three Rockwood paper pulleys. Motor is mounted on one pivoted base. This equipment, the counter shaft and its pulleys are supported on the frame, which is also mounted on a pivoted base. Proper tension is thus maintained in both belts by pivoted bases. *Rockwood Mfg Co, 1801 English Ave, Indianapolis, Ind.*

14 COMPOSITION BELTING—Round composition belting designed for light machinery consists of a strong inner core around which is attached a thick composition surface. Core is claimed stronger than steel and able to stand indefinite amount of flexing. To fasten ends of this belting, two in. of composition are removed and core ends tied together. *Sudbury Laboratory, South Sudbury, Mass.*

15 PORTABLE ELECTRIC HOIST—"Budgit" hoist of 500 lb lifting capacity weighs complete 58 lb. Operating from lighting socket, no additional wiring or special conductor systems are required. Lifting speed with 500-lb load is 17 fpm. Roller chain is used instead of usual link chain. *Shaw-Box Crane & Hoist Div, Muskegon, Mich.*

16 AUTOMATIC VARI-SPEED CONTROL —"Motodrive", a variable-speed control unit has been on market for some time. Mechanical automatic control, however, is new device to regulate speed of Motodrive. On motor (constant-speed) shaft of Motodrive is a cover plate including a lever bracket and extended lever that can be attached directly by cable or chain to a compensating or floating roll (where properly balanced by weights), pressure regulator, etc, from which indication of required speeds can be taken. *Reeves Pulley Co, Columbus, Ind.*

17 ADJUSTABLE SHEAVE—Single-groove, adjustable sheave has a range of pitch diameters by moving adjustable plate, reversing and again placing on hub. Outer plate in position shown at left allows Texrope belts to rise high and give pitch diameter from 3 to 4 in., outer plate reversed in position shown at right allows belts to ride low and give pitch diameter from 2 to 3 in.; the two together provide for speed variation of 100%. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

18 MOTOR TROLLEY—Type RB motor pulley is a separate unit for combination with Class B Lo-Hed hoists. Short wheelbase, low headroom, 4-wheel drive and balance. Curves with a radius down to 7 ft can be negotiated. Headroom varies from 1 ft 9 in. to 3 ft 10 in., depending on capacity of hoist and height of lift. Four trolley wheels are all motor driven, providing maximum tractive effort. *American Engineering Co, Philadelphia, Pa.*

19 SMALL HOIST—"Rope Guide Hoist" has drum with deep grooving, allowing cable to be completely submerged within grooves. Traveling guide has finger which runs in groove ahead of cable and holds it in proper groove. Worm drive with worm and wheel running on tapered roller bearing enclosed within gear case. Sizes ¼ to 5 tons. *Electro Lift Inc, 30 Church St, New York, N. Y.*

20 LEATHER BELTING—Belt face is made of imported-chrome leather. Since its cost, when new, is prohibitive for belting, maker uses leather reclaimed from industrial purposes, which, by taking stretch out of leather, is claimed to improve its quality as belting. Strong backing of special impregnated fabric. *Sudbury Laboratory, South Sudbury, Mass.*

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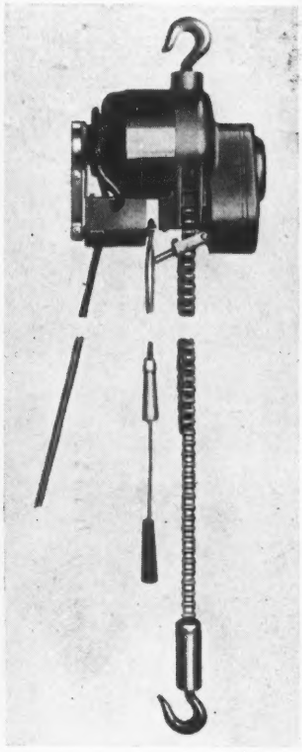
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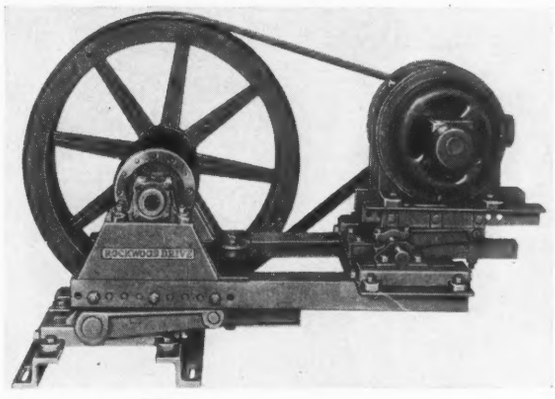

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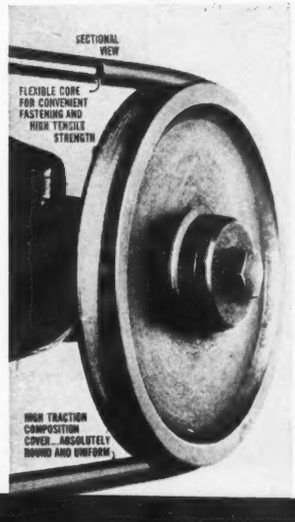
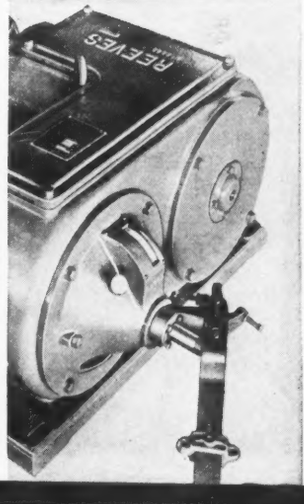

SECTIONAL VIEW
FLEXIBLE CORE FOR CONVENIENT FASTENING AND HIGH TENSILE STRENGTH
HIGH TRACTION COMPOSITION COVER... ABSOLUTELY ROUND AND UNIFORM



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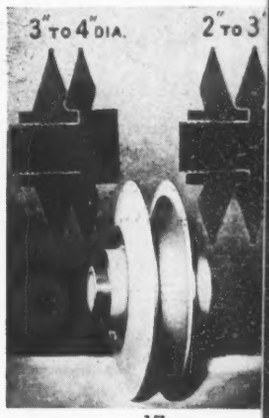

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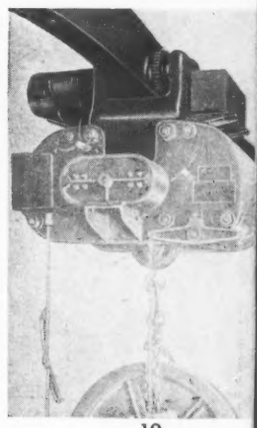
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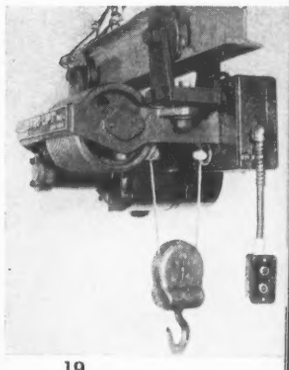
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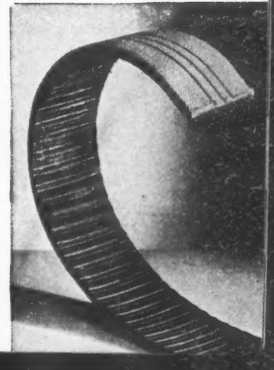
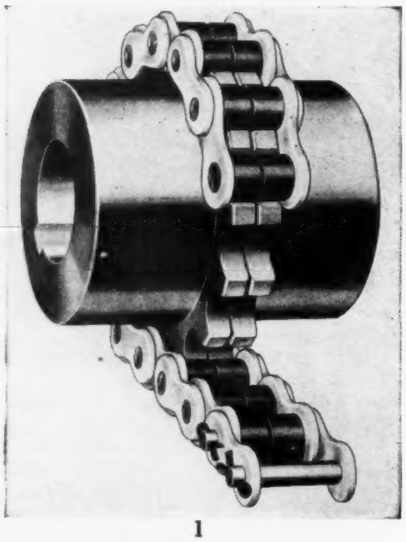


1 FLEXIBLE COUPLING—Type RCB coupling consists of two cut-tooth sprocket wheels connected by a piece of specially constructed single-width finished-steel roller chain, using a recently patented divided-roller feature. Divided roller provides independent roller action for each sprocket, and as contact between roller and sprocket causes roller to revolve on its bushing, any tendency to scuff rollers and sprocket teeth is said to be avoided. *Link-Belt Co, 407 N Michigan Ave, Chicago, Ill.*

2 CLUTCH—Tapered rolls used in this clutch are free to float in any direction and when forced into engagement, do not grip instantly, but are retarded just enough to relieve motor or other prime mover, from sudden shock load. Rolls are carried in a sleeve that is free to slide horizontally over a fixed hub. Sleeve is controlled by toggles connected to a sliding collar, which in turn is actuated by a standard shift collar and suitable pivoted lever for operating clutch. *Ramsey Chain Co, Albany, N.Y.*



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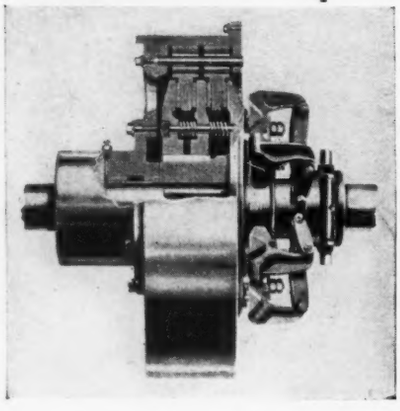
3 PILLOW BLOCK—Feature of Line of "Sealmaster" ball-bearing pillow blocks is permanent seal principle—two inner and two outer seals. Inner seals, one at each side of bearing, are pressed into outer ring and become permanent part of bearing, forming tight grease chamber for race grooves and rolling elements. External flinger seals are pressed into position upon land of inner race ring, and are lined with felt applied with cellulose cement. *Stephens-Adamson Mfg Co, Aurora, Ill.*

3

4 FRICTION CLUTCH—For oil-, gas- and diesel-engine drives, etc. Disks are driven by steel pins, cushioned by rubber bushings. These bushings have special self-lubricating bronze bushings on inside of rubber, so disks slide freely on steel pins. Combines features of friction clutch and flexible coupling. *T B Wood's Sons Co, Chambersburgh, Pa.*



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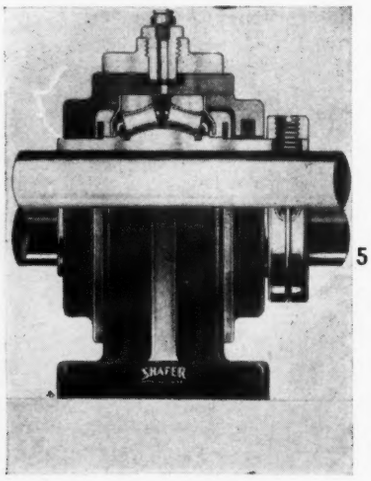
5 PILLOW BLOCKS—Two lines of pillow blocks have welded-steel housings and seal to protect against dirt. First, see illustration, has large recesses formed by inner seal plates and covers which prevent contamination of lubricant within bearing chamber. For shaft sizes 1 7/16 to 3 5/16 in. Second line has automatic compensation for misalignment or shaft deflection up to 1½ deg each side of center. Available in sizes from 1 7/16 to 8½-in. bore. *Shafer Bearing Corp, 35 E Wacker Drive, Chicago, Ill.*



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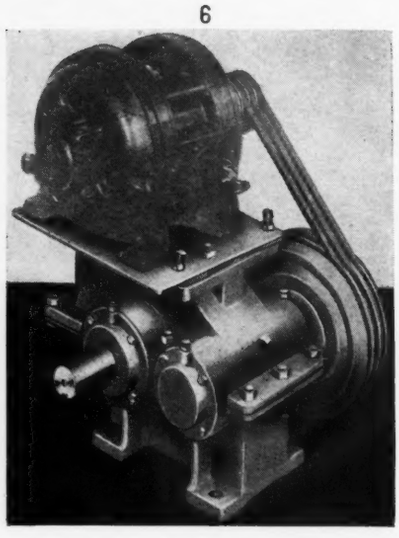

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6 SPEED REDUCER—Line of JFS variable-speed reducers has adjustable motor supports for V-belt drives, permitting sheaves to be replaced to suit changes in required output speed. Range of output speed varies from 13.2 to 172 rpm. All shafts are mounted in precision ball bearings and precision-cut helical steel gears operate in a constant bath of oil. *Stephens-Adamson Mfg Co, Aurora, Ill.*

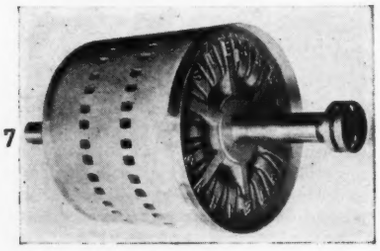
7 MAGNETIC PULLEY—Improved high-duty magnetic pulley, for removing tramp iron from conveyed coal, has new ribbed construction, including deeper coil pockets that allow for more copper wire and more ampere turns with consequent greater magnetic strength. Nonmagnetic end rings of alloy steel extend beyond active face of pole and support unloaded edges of belt, confining magnetic force of pulley to active portion of belt. *Stearns Magnetic Mfg Co, Milwaukee, Wis.*

8 VARIABLE-SPEED TRANSMISSION—Makes use of metallic rolling contact to transmit power at infinitely varying speeds, output speed varying from any desired maximum down to zero speed and reverse. Pressure applied by cam to tapered rollers brings them in driving contact with a cylindrical ring, which is movable lengthwise of the transmission to change speed from approximately ⅓ of input speed down through zero and reverse. *Graham Transmissions Inc, Milwaukee, Wis.*

BELT IDLER—Ball-bearing belt idler for moderate loads is conventional 3-pulley, 20-deg troughing type. Gudgeons are connected within pulley by steel tubing to prevent loss of grease. Shifts are ⅝-in. seamless tubing held by set screws within machine-bored holes in stands. As shafts are hollow, entire idler may be lubricated from either end through pressure fittings. *Jeffrey Manufacturing Co, Columbus, Ohio.*

CONVEYOR BELT—"Paranite" gas-oil-proof conveyor belting serves coal conveyors where coal is sprayed with oil. Paranite friction compound covers both sides of belt and resists abrasion of material carried as well as oil. Made in regular widths, plies and covers. *Manhattan Rubber Mfg Div, Raybestos-Manhattan, Inc, Passaic, N.J.*

CARDING BELT HOOKS—New method of carding "Wiregrip" belt hooks said to keep each hook in exact position, speed loading of lacing machines and prevent waste of short ends cut from cards of hooks. With this system of carding, desired number of hooks can be cut



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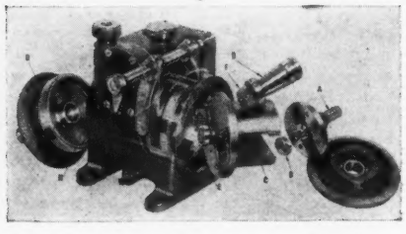

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off easily with a pocket knife or scissors. *Armstrong-Bray & Co, 304-310 N Loomis St, Chicago, Ill.*

CHAIN DRIVE—Duplex chain resembles in appearance two narrow side-guide chains constructed so that links of each are pointing in opposite directions in order to drive sprockets from each side. Narrow-faced sprockets are used, engaging only one half the chain, with their hubs supporting other half not in engagement. For operating groups of rolls or other installations where sprockets must be close together. *Ramsey Chain Co, Inc, Albany, N.Y.*

METERS AND INSTRUMENTS

1 NALCO BLINKER—This instrument acts as a continuous indicator of correct solids content in condensate, steam, feed or boiler water, and for checking quantity of dissolved solids in any water containing from 1 ppm to 700 grains per gal. Commonest use is to check continuously solids in main steam header by taking a continuous sample of steam through a cooling coil and reducing to a temperature below 100 F. Condensed steam is than passed through an electrode connected by wire to Blinker, which may be in any convenient location. *National Aluminate Corp, 6216 W 66th Place, Chicago, Ill.*

2 VIBROMETER—Instrument for measuring amplitude of vibration of structural or machine members has range of .001 to .030 in. amplitude. When needle point is held against vibrating part, motion of spindle is transmitted directly to vibrometer (which appears as bright yellow against black background). *American Instrument Co, Inc, 8024 Georgia Ave, Silver Spring, Md.*

3 pH METER—"Beekman" industrial pH meter uses glass electrodes immersed in test solution. Minute electric potential is generated that varies with pH. This potential is strengthened by an electronic amplifier to operate a calibrated meter, reading in pH. If electrodes are placed in a flowing solution or in a tank where pH is subject to fluctuation, and switch kept on, meter will continuously indicate pH. Dual-scale meter controlled by switch covers acid range 0 to 7 on one adjustment and alkaline range 7 to 14 on the other. *National Technical Laboratories, 3335 E Colorado Blvd, Pasadena, Calif.*

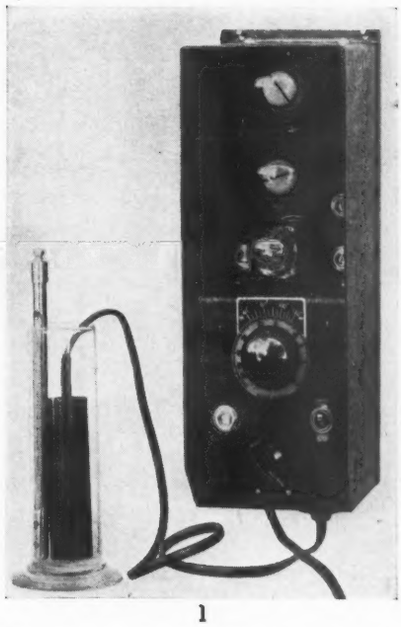
4 HAND TACHOMETER—Hand makes two revolutions in each speed range instead of customary one. Three measuring ranges: 25 to 300 rpm, 350 to 3000 rpm, and 2500 to 30,000 rpm, all engaged by turning knurled ring. Cross-pendulum type results in "dead beat" hand indications. *Coats Machine Tool Co, Inc, 110 W 40th St, New York, N.Y.*

5 POTENTIOMETER PYROMETER—Multiple recording potentiometer records in multicolor and numerals. One symbol, plus (+) sign is used; vertical line of sign identifies temperature and horizontal line the time coordinate. Intersection of lines locates exact time-temperature record. 12-in. chart and number-print wheel make it possible to record continuously from two to six temperatures from as many different thermocouples. *Brown Instrument Co, Philadelphia, Pa.*

6 TACHOMETER—High-speed tachometer has speed range up to 100,000 rpm. Operates on chronometric principle, incorporating a Swiss precision watch movement. One revolution of large hand, which represents 10,000 rpm, is subdivided into 100 rpm. A tell-tale hand counts up to ten turns of large hand, thus indicating from 10,000 to 100,000 rpm. *George Scherr Co, 128 Lafayette St, New York, N.Y.*

7 PORTABLE PYROMETER—Shock-proof pyrometer has these essentials: spring-suspended movement within case to minimize shock and jars; shock-resisting movement with pivot and jewels; new type pointer lock to damp movement of instrument when carried; heavy metal case; and scale length of 5 in. *Illinois Testing Laboratories, Inc, Chicago, Ill.*

8 PORTABLE POTENTIOMETER — Field- and lab-service potentiometer built in three models: No. 310, with cold-junction compensator; No. 320 with cold-junction compensator and run-up box; and No. 330 with these two elements plus standard thermocouple line-compensating rheostat. Standardized with regulation cell, precision slide wires and multipliers. *Wheelco Instruments Co, 1933 S Halsted St, Chicago, Ill.*



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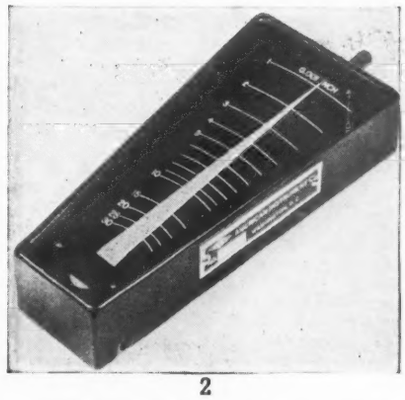

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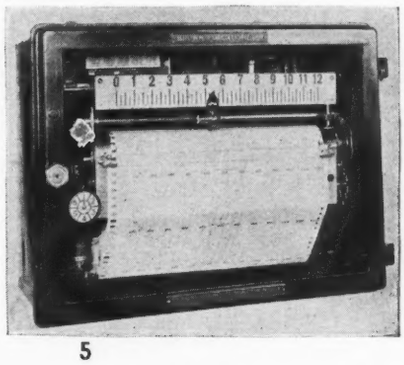

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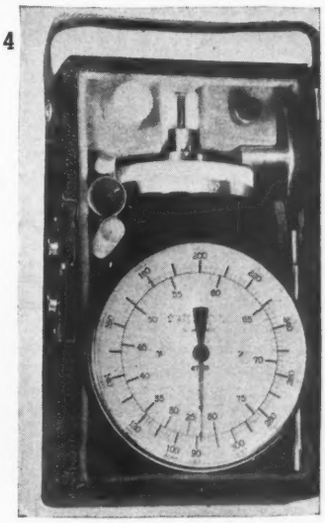

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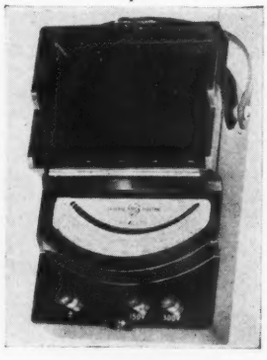

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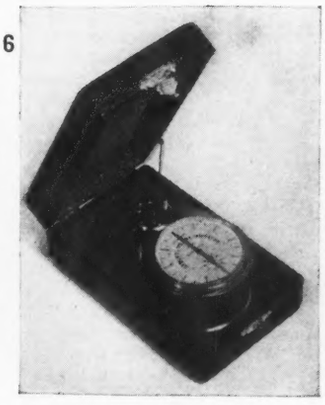

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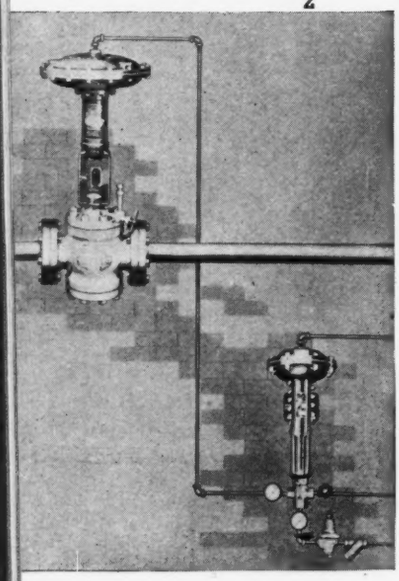

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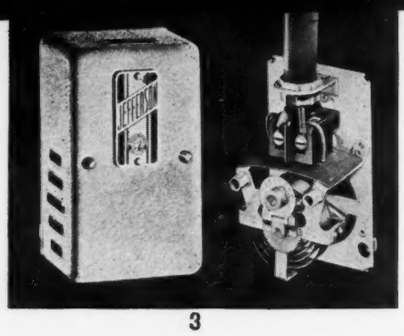

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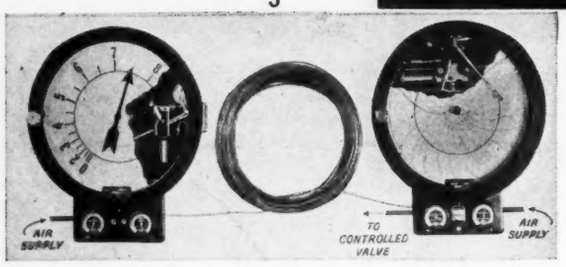

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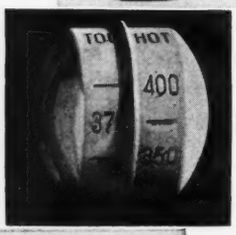

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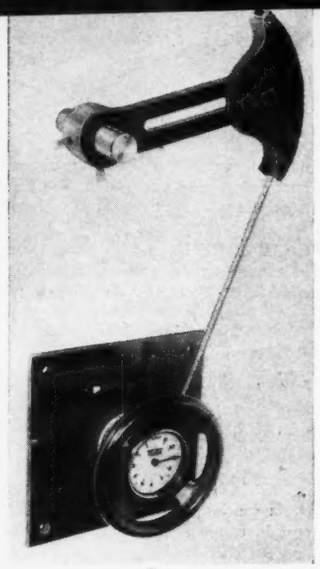

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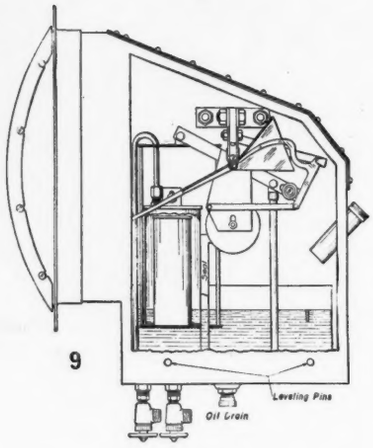

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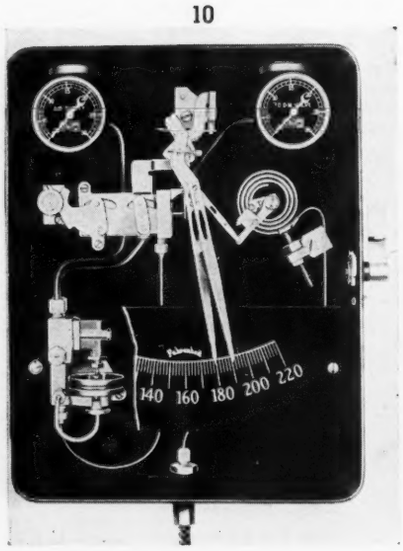

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1 BRINELL INSTRUMENT—Light-weight, portable "Telebrineller" consists of metal tube supported in soft rubber head, rubber spacing block, tube for holding bar of unknown hardness. To make test, instrument is held against specimen and anvil struck a sharp blow with 3- to 5-lb hammer. Diameters of impression are then measured in 1/10 millimeters by placing microscope over each in turn and reading scale. Brinell hardness is figured by arithmetical formula or slide rule. *Teleweld, Inc, Railway Exchange Bldg, Chicago.*

2 PRESSURE CONTROLLER—"Synchromaster" pressure controller is hydraulic-operated combination of pilot mechanism and diaphragm-actuated control valve. Hydraulic-supply pressure of 20 to 150 lb. Since pilot bleeds only when control-valve-diaphragm pressure is reduced, water consumption is low. Controlled pressure is piped to pilot-valve diaphragm and is balanced by setting of springs. Increases or decreases in this pressure move piston valve to increase or decrease control-valve-diaphragm pressure, positioning valve plug to maintain pressure. *Mason-Neilan Regulator Co, Boston.*

3 TEMPERATURE CONTROL — Tamper-proof air-switch has control knob and scale plate removed from outside of enclosing case, and range adjustment can be made only by removing case. Absence of usual control knob removes temptation to tamper. *Jefferson Electric Co, Bellwood, Ill.*

4 RATIO METER—Direct-reading ratio meter has two flow-metering elements, one for air and one for gas. Pointers cross in the chart area so that intersection of pointers indicates relation between two flows. As long as pointers cross on vertical or zero line, a neutral flame is being maintained. If they cross in area to right, there is shown percentage of excess air. Conversely, if pointers cross at left, there is shown air deficiency. *Askania Regulator Co, 1603 S Michigan Ave, Chicago, Ill.*

5 PNEUMATIC TRANSMISSION—Remote-transmission system consists of transmitting indicating instrument at point of operation, and a receiver, which can be indicator or recorder, at remote master-control board. Remote transmission is balanced air pilot, mechanically actuated, built into indicating transmitter. Receiver is either an indicating or recording pressure gage, calibrated in terms of variables being measured. Illustration shows indicating flow transmitter at left, transmission tubing at center, and recording and controlling flow receiver at right. *Brown Instrument Co, Philadelphia, Pa.*

6 HAND TACHOMETER—O-Z hand tachometer has range of 40 to 50,000 rpm and 12 to 15,000 fpm. Indicating mechanism is in black enameled housing with fixed reading device, controlled by pushbutton in front. Three selective range steps of 40–500, 400–5000 and 4000–50,000 rpm; and with cutmeter wheel: 12–150, 120–1500 and 1200–15,000 fpm. *O Zernickow Co, 15 Park Row, New York, N.Y.*

7 THERMOMETER — "Thermosphere" all-metal floating thermometer is a chromium-plated steel sphere about 1¼ in. in diameter and with numbers around one circumference. Instrument floats in liquids and after slowly rotating to rest, figure at highest point indicates temperature. Through diameter of sphere is a shaft to which is welded inside end of bimetal spiral coil, to other end of which is welded a weight. Temperature changes cause coil to unwind, and shell revolves around shaft. *Raytheon Mfg Co, Newton, Mass.*

8 DAMPER CONTROLLER—Indicating damper controller is mounted on either front or side of boiler. Controller operates damper by means of adjustable eccentric quadrant and lever arm connected to controller by cable. In combination with Tejax dial-indicator control valve, proportionate fuel-flow and air-flow settings can be obtained. Valve is mounted in line as near burner as possible, and has straight-line flow characteristic in relation to handwheel turns indicated by dial. *Tefft-Jackson, Inc, Providence, R.I.*

9 AIR-FLOW GAGE—Gives accurate measurement of air and gas across an orifice in cfm or cfh on a scale of equal divisions. Square-root movement consists of pointer with camtrack in counterweight of pointer and a cam linked to gravity arm of power unit. Pointer is carried on knife-edge fulcrum bearings underneath fulcrum bearings of power unit. Power unit consists of gasometer bell, moving within stationary bell. *Ellison Draft Gage Co, 214 W Kinzie St, Chicago, Ill.*

10 INDICATING CONTROLLER—Direct-set "TAG" indicating controllers made

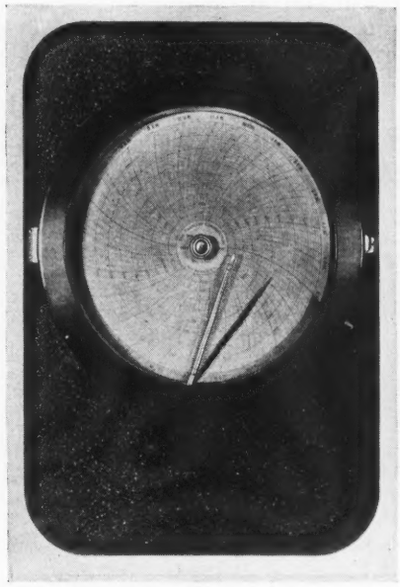
in two types: "On-Off" and throttling, Model No. 9-TIC for temperature and No. 9-PIC for pressure. On-Off instrument will open diaphragm valve if temperature is slightly below setting point, and will close valve if temperature rises slightly above. Throttling controller is identical except for adjustment flapper that provides sensitivity adjustment from hairline to 100% throttling range. *C J Tagliabue Mfg Co, Park & Nostrand Aves, Brooklyn, N.Y.*

11 TEMPERATURE CONTROLLERS—Models AR and ARF recording controllers, for temperatures up to 100 F, use sensitized paper and stylus for making permanent records on 10-in. round chart. Three types made: Red Top—normally on, 2-wire circuit control, capacity 500 watts ac, 50 watts dc; Green Top—normally off, 2-wire control circuit, capacity 500 watts ac, 50 watts dc; Blue Top—3-wire thermostatic control or single-pole, double-throw, capacity 200 watts ac, 25 watts dc. *Partlow Corp, New Hartford, N.Y.*

12 POTENTIOMETER CONTROLLER—Reset potentiometer controller for continuous processes combines Bristol "Pyromaster" potentiometer temperature-measuring system and reset "Free-Vane" air-operated control mechanism. Temperature-measuring system is electrical, operating on potentiometer principle. Reset air-operated control mechanism records true temperature above, below and at control point. Field adjustability has been increased, whereby throttling range and rate of reset may be changed over wide scope. *Bristol Co, Waterbury, Conn.*

13 REMOTE MANUAL CONTROL—Integral manual control provides for remote control without leaving front of instrument. Operator is able to shift from manual to instrumental control, or vice versa, without disturbing control-valve-diaphragm pressure, even momentarily, because operator is able to synchronize manual-unit output with pilot-system output before shifting mode of control. *Mason-Neilan Regulator Co, 1190 Adams Street, Boston, Mass.*

14 LOW-RANGE DRAFT AND PRESSURE RECORDERS AND CONTROLLERS—Developed for recording and controlling low pressure and vacuum. Made in ranges of from 0 to 0.2 up to 0. to 2.0 in. of water. Readings can be made as closely as .001 in. of water. Measuring element is an inverted oil-sealed bell, balanced through a lever by means of a helical spring. Pressure to be measured is exerted on under side of bell, which causes it to move in proportion to changes in pressure. *The Bristol Co, Waterbury, Conn.*



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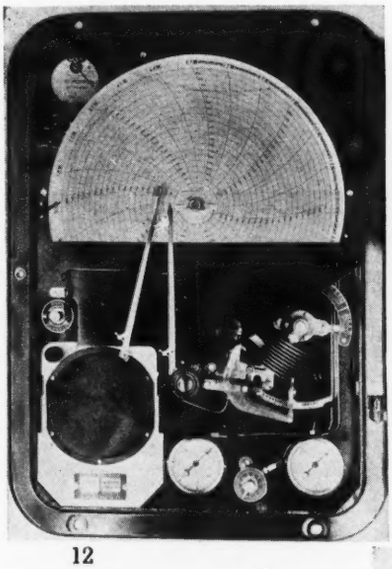
15 COUNTER CONTROL UNIT—Photoelectric counter unit has light louvre system to cut off all extraneous light, and a corrected condensing lens to direct full light energy upon photo cell. Atop steel cabinet is amber light that signals each step of counter cylinder. ¾ in. separation of parts will serve to actuate counter, on 110 volts ac or dc. *Wayne Automatic Relay Co, Fort Wayne, Ind.*

16 TELEMETERING SYSTEM—Pneumatic telemetering system for recording and controlling temperature, flow, pressure and liquid level, known as "Metavane System," consists of two instruments: transmitter and receiver. Transmitter measures variable in question, indicates its value on a scale for operator, and transmits reading to receiver, which may be several hundred feet away. Two instruments are connected by copper tubing. 15-lb air supply introduced at transmitter provides power to telemetering system. *The Bristol Co, Waterbury, Conn.*

17 LIQUID-LEVEL CONTROLLER—Type 246 "Level-Trol" can be used on liquids of all gravities. An anchored cantilever spring supports float, which is especially weighted to sink in liquid being handled. As liquid rises, that displaced by float creates a buoyancy that partially relieves cantilever spring. As spring returns to normal position, action is transmitted to pilot valve by an arm that contacts spring through a small rotary stem. It is claimed that a level change as small as 1/32 in. will register a pressure change at diaphragm. *Fisher Governor Co, Marshalltown, Iowa.*

18 HAND TACHOMETER — "Universal" hand tachometer measures from 30 to 40,000 rpm with only three ranges. Operates on same principle as Biddle Type C instruments, but has been redesigned to include ball bearings, knife-edge pointer, rotating gear shift and other refinements. Made in two ratings: 30 to 40,000 rpm and 25 to 30,000 rpm. *James G Biddle Co, 1211 Arch St, Philadelphia, Pa.*



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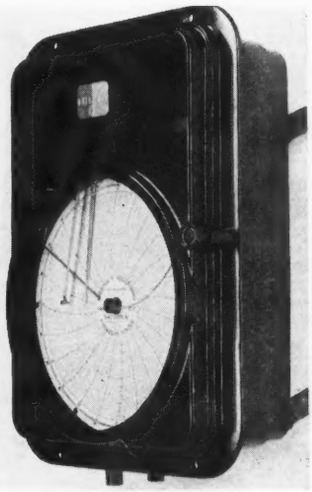

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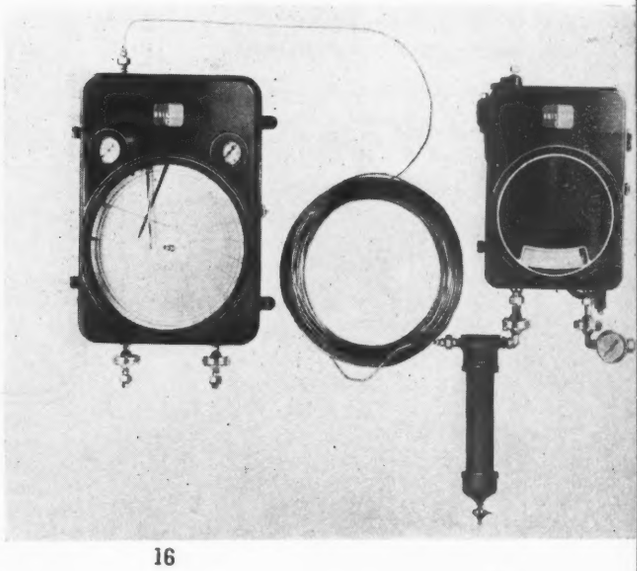

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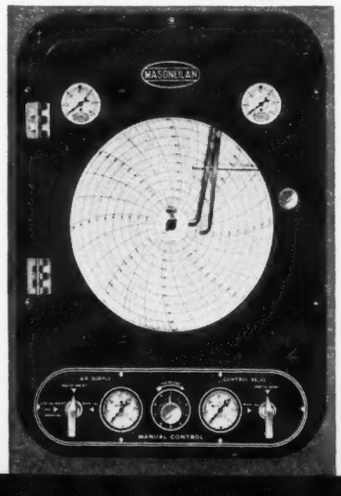

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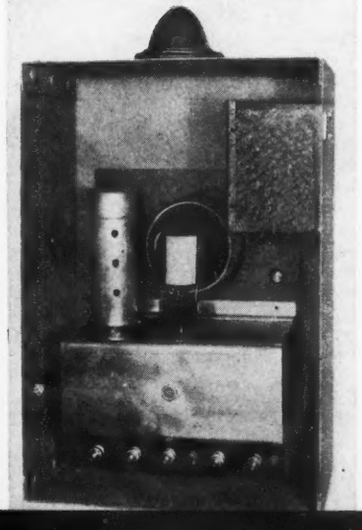

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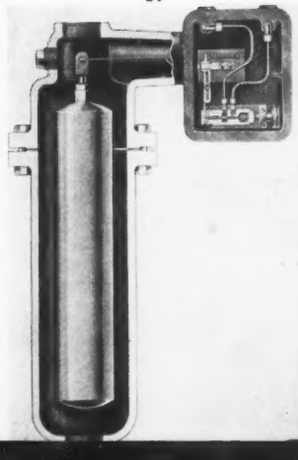

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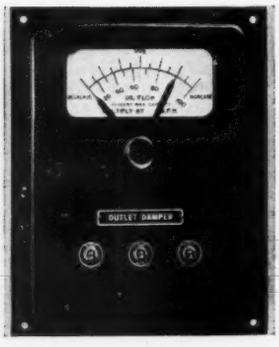

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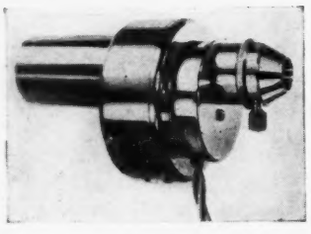

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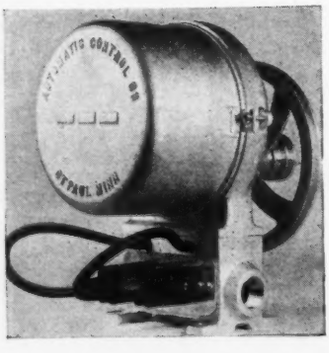

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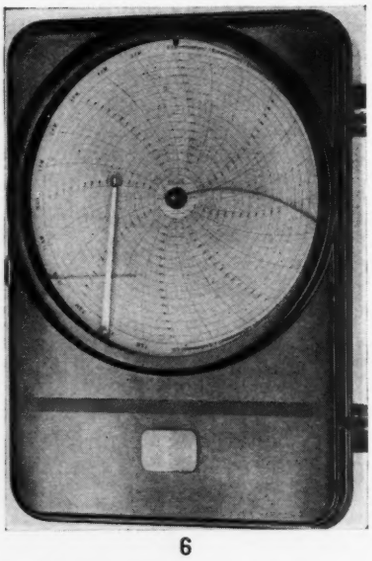

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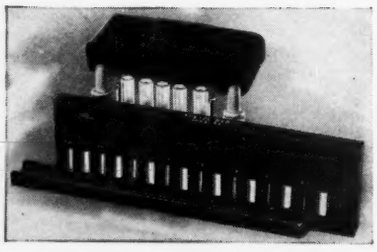

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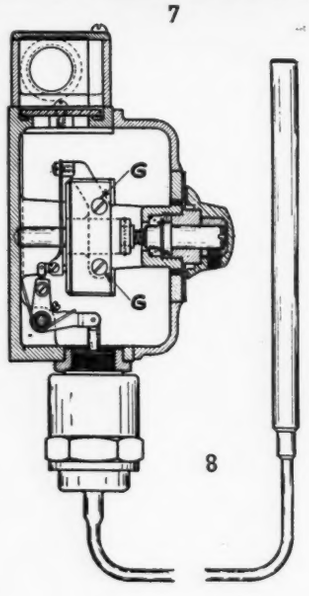

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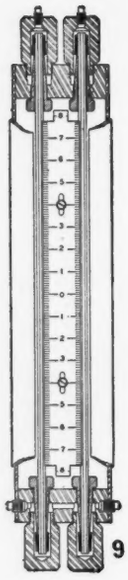

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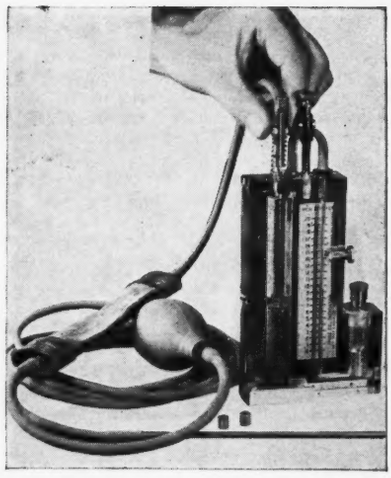

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1 TEMPERATURE GAGE—Line of temperature gages are dial-and-pointer type, and are said to be first industrial application of new coil-within-coil design for bimetal temperature-sensitive elements. This all-metal temperature element is sheathed within a stainless-steel stem. Circular dial case is mounted at right angles to and at top of stem. Accuracy is guaranteed to 1% over entire scale. *Weston Electrical Instrument Corp, Newark, N.J.*

2 OIL-FLOW RATIO CONTROL—Proportions quantity of air to quantity of oil being fed to burners. Oil to burner is piped through oil-flow element. Its flow creates a differential pressure which causes a movement of bimetallic bellows proportional to square of oil flow. This movement operates metering shaft upon which are connected two levers, one operating loading spring, other the flow indicator. Tension of loading spring is impressed upon air-control unit so that variations in oil flow cause a movement of diaphragm. This movement causes a magnet to make contact with mercury switch, starting power unit to move damper in forced draft or boiler outlet, thereby bringing air flow to new quantity which oil flow requires. *The Hays Corp, Michigan City, Ind.*

3 THERMOCOUPLE PILOT—Automatic thermopilot for natural and manufactured gas. When flame is applied to thermocouple element, contact is made, allowing main gas valve to open. When gas pilot light fails, thermopilot opens circuit to main gas valve. Automatically resets itself when pilot is relighted. *General Controls Co, 1370 Harrison St, San Francisco.*

4 RADIATION PYROMETER—"Ardometer" measures hot-surface temperatures of hot objects above 1000 F, when Ardometer is sighted so that it picks up heat rays emitted. Temperature is recorded on one of Bristol's potentiometers, or on millivoltmeter pyrometer. Can be sighted directly on object in furnace and in this position measures instantly temperature of object. *The Bristol Co, Waterbury, Conn.*

5 FLOAT CONTRAL—"Floatrol" is a 1-, 2- or 3-circuit pilot control mechanism operated by single float. Is primarily designed to control two or three pumps in simple sequence, cutting pumps in progressively as demand requires and cutting them out in reverse order or all together. Transfer plugs are available for changing manually pumping sequence. Can be used for other purposes in control of pumps, valves, alarms, etc. *Automatic Control Co, 2590 University Ave, St. Paul, Minn.*

6 PYROMETER—Potentiometer-pyrometer and resistance-thermometer unit has no continuously moving parts or trains of gears and require no lubrication. When unbalanced condition in potentiometer circuit occurs, series of relay-actuated switches operate motor to position slide-wire contact, to which pen arm is attached. Temperature ranges of 0 to 500 up to 0 to 3000 F. Made as recorders, indicators, indicators-recorders, recorder controllers, and recorder controllers with indicating scale. *The Bristol Co, Waterbury, Conn.*

7 pH SLIDE COMPARATOR—For colorimetric determination of pH, chlorine and phosphates. Base contains two vials of indicator solution, with 0.5-cc pipettes, 5-cc test tubes and piece of etched glass in special compartment. Determinations are made by filling three of test tubes with test sample, adding 0.55 cc of indicator solution to middle one, placing slide on base and moving it back and forth until test sample matches one of color standards. pH, chlorine or phosphate value is then read off directly from values on slide. *W A Taylor & Co, 872 Linden Ave, Baltimore, Md.*

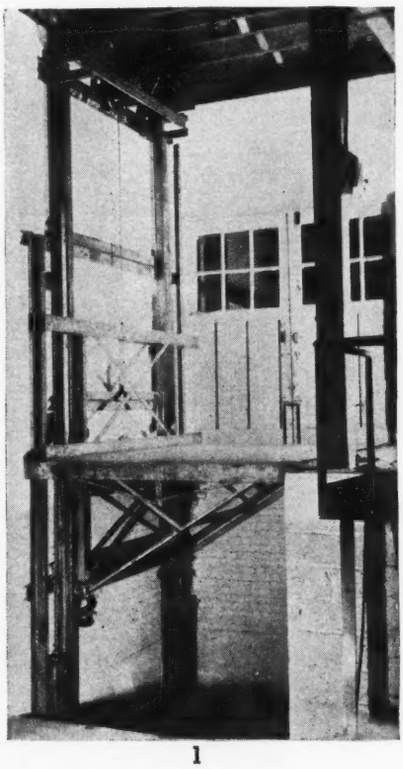
8 TEMPERATURE CONTROLLER—Model Z electric temperature control includes thermostatic element and 5-ft length of capillary tubing. Control unit has switch with either normally closed, normally open or single-pole, double-throw contacts. On face of housing is temperature-setting unit consisting of knurled knob and porcelain-enameled dial. For air heaters, baking ovens and similar devices heated by gas, electricity or oil. *Partlow Corp, 12 Campion Rd, New Hartford, N. Y.*

9 HIGH-PRESSURE MANOMETER—Wilcox straight-tube, high-pressure manometer for pressures up to 1000 lb permits use of straight tubes that are sealed against leakage by synthetic rubber sleeves, thus eliminating strain in glass. Because there is no U-bend and only lightest contact between glass and metal, there is said to be no distortion of tubes when seal is made. *Daniel Orifice Fitting Co, 3352 Union Pacific Ave, Los Angeles, Calif.*

10 STACK-TEMPERATURE THERMOMETER—Incorporates reversible combined "case-handle". Standard range of 30 to 900 F in 10-deg divisions. Thermometers are lens-fronted, providing ease of reading. 7½ in. long. *Julien P Friez & Sons, Baltimore, Md.*

11 CO_2 INDICATOR—Improved indicator is made of new transparent composition unaffected by caustic solutions used in instrument. Highly polished, chromium-plated, graduated adjustment scale makes possible accurate readings because errors of parallax are said to be eliminated. Readings are obtained by lining up meniscus of vertical mercury column with graduations on adjustable scale and reflection of meniscus in that polished scale. *Julien P Friez & Sons, Baltimore, Md.*

THERMOSTAT—"Two-Stage Sensatherm" has two dust-proof sealed mercury-contact switches, operated by one bimetal coil and two permanent magnets. For room-temperature control on high-low-fire gas or oil burners, for eliminating overshooting temperatures on stokers with forced-draft-circulation warm-air systems, and for regulating 2-speed fans. *Mercoid Corp, 4201 Belmont Ave, Chicago, Ill.*



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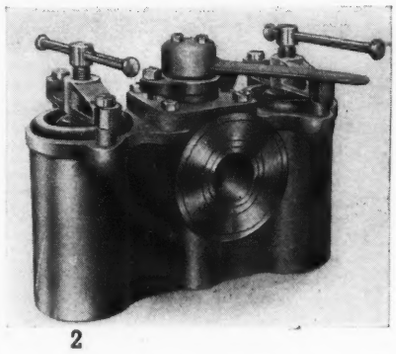

2

MISCELLANEOUS

1 FREIGHT ELEVATOR—"Wallclimber" for 1-story service, lifts up to about 12 ft. Guides and supports can be removed and set up in new location of similar dimensions. Capacities up to 5000 lb, and car sizes to 7 x 10 ft. Rails, cables, anchorage and counterweights are placed along one side only, while elevator machinery is overhead. Instantaneous self-aligning safeties act in event of cable breakage. *Revolvator Co, North Bergen, N. J.*

2 OIL STRAINER—"Duoflo" suction oil strainer, made of semi-steel, has two perforated baskets held in place by covers, which allows one strainer to be cleaned while other is operating. All suction flanges are drilled to American Standard specifications. Each assembly is tested to 150 lb psi before shipment. For industrial oil-burning furnaces, oil-processing lines, etc. *Sheffler-Gross Co, Inc, 5th and Chestnut Sts, Philadelphia, Pa.*

3 AUTOMATIC STRAINER—Self-cleaning unit consists of strainer, operating motor, pressure switch and diaphragm-operated gate valve in waste-discharge connection. As solid matter accumulates in strainer basket, pressure at strainer outlet drops slightly. Then switch closes, starting motor, rotating basket, and discharge-gate valve opens in waste line. Rotation of basket causes one section after another to be cleaned by flushing. *Blackburn-Smith Mfg Co, Inc, Hoboken, N. J.*

4 GAS-AND AIR-LINE FILTERS—Types 360 and 361 filters remove foreign matter and separate free moisture from air and gas pipelines. These filters use aluminum oxide crystals bonded together as filter element, which is acid and heat resisting. Flanged and bolted bottom castings permit easy removal for cleaning. Made in sizes ¼ to 1¼ in., and with flanged connections from 1½ to 2 in. *Fisher Governor Co, Marshalltown, Iowa.*

5 FILTER—Type FKR "Flo-Klean" filter for removal of fine dirt and sand from river water is a self-cleaning wire-bound filter of low pressure drop and has no loss of backwash water. Cleaning is continuously accomplished by slowly rotating a cartridge past a stationary backwash nozzle. Motor drive, backwash pump, blowoff valve and all auxiliary equipment are mounted on filter base, so that upper sump can be removed quickly for inspection of cartridge. *Cuno Engineering Corp, 284 S Vine St, Meriden, Conn.*

6 SELF-CLEANING STRAINER—For removing relatively large quantity of fine dirt, sand, etc, from water which has already passed through a traveling screen or conventional twin or single strainer, Type K strainer is cleaned by continuous back flushing of strainer element. Straining cartridges are made of alternate layers of flat and corrugated copper strips. Made in sizes from 4 to 24 in. for pressures from 25 to 125 lb g. *Elliott Co, Jenette, Pa.*

PRESSURE LUBRICATOR—"Acco-Morrow" pressure lubricator supplies pressure up to 1000 lb. "Oilingseal" tip, made of compressible composition, makes a pressure-tight contact on top edge of any common oil hole and practically all sizes and types of cups and oil-hole covers in general use. Plunger in bottom of unit furnishes pressure. *American Chain & Cable, Inc, York, Pa.*

VIBRATION INSULATION—Type 40 "Vibro-Insulator" uses adjustable deflection principle, which enables user to provide either soft or stiff mounting. Rubber is vulcanized to two parallel metal disks which are drilled and tapped for a 5/16-in. USS thread. Hole extends through entire length of mounting, and deflection is varied by length of attaching screws. One size only: 1 in. diameter, 1 in. long and carries max. load of 10 lb per mounting. *B F Goodrich Co, Akron, O.*

CYLINDER-HANDLING TRUCK—For handling heavy cylinders of anhydrous ammonia, chlorine, etc. By a special frame and clamp device, operator can select tank from storage line without disturbing other tanks. Push of lever clamps tank to truck frame. Large wheels and roller bearings allow truck to go over rough floors with ease. *Lewis-Shepard Sales Corp, 245 Walnut St, Watertown, Mass.*

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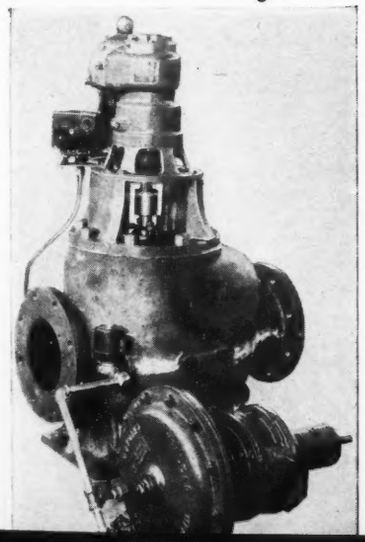

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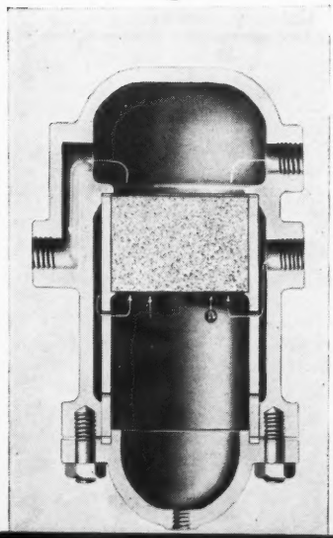

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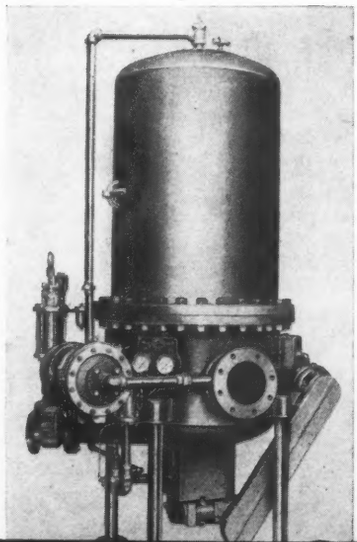

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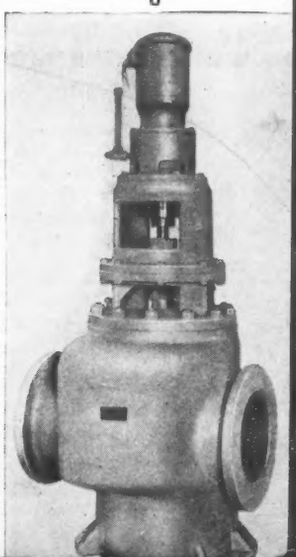

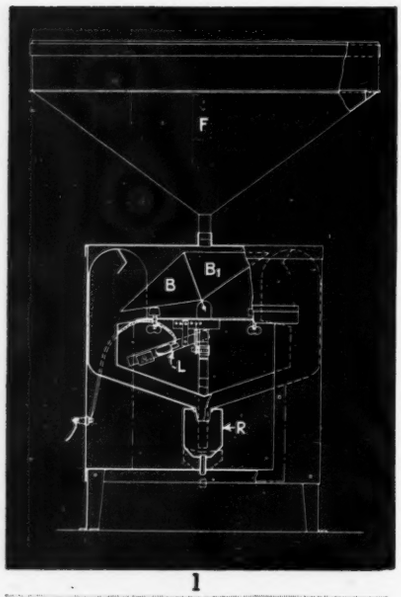

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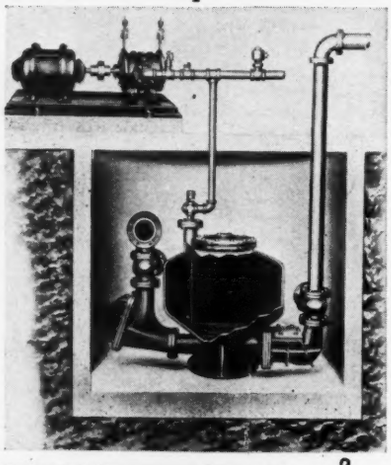

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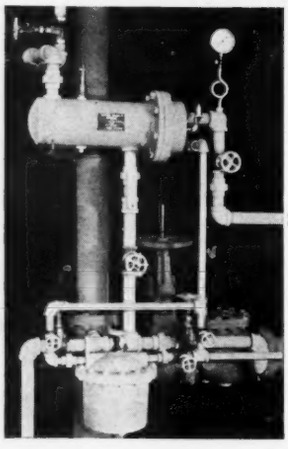

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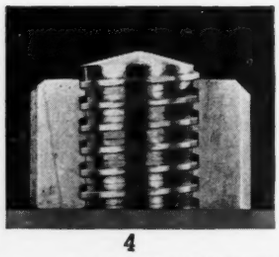

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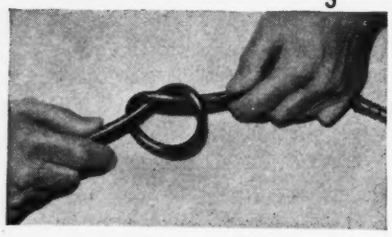

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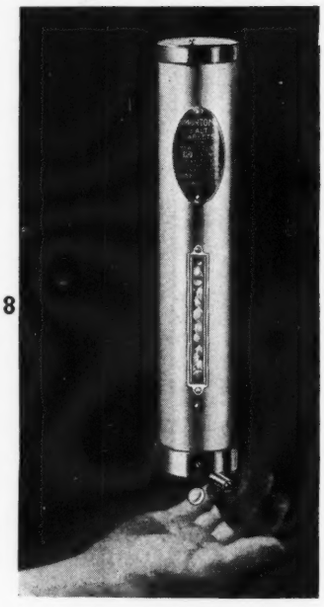

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1 RAIN GAGE—Hildabrand remote recording rain-gage system can measure rainfall at several remote stations and transmit these measurements to a central station where they are recorded automatically. Funnel *F* collects rainfall, which runs into either one of two measuring buckets, *B* and *B1*. Flow from dumping bucket goes into receptacle *R*. This receptacle is attached to one end of lever *L* on which is mounted a mercury switch. When water is dumped into *R*, it overbalances lever *L* and closes mercury switch to give a record. *Technical Products Co, Inc, 6670 Lexington Ave, Los Angeles, Calif.*

2 SEWAGE EJECTOR—Type SEC "Shone" electrically operated ejector for large buildings, booster stations, etc, uses compressed air to eject sewage. Air is admitted to ejector when pot is filled, and is shut off when pot is discharged by stationary electrical contacts. Has no float or bells, float switches, air tank, stuffing boxes, or moving parts on or inside ejector; otherwise, operation is same as conventional units. *Yeomans Bros Co, 1433 Dayton St, Chicago, Ill.*

3 STEAM TANK HEATER—Designed specially for sprinkler tanks as a safeguard against freezeups. Cold water is taken into heater cylinder from the storage-tank discharge pipe. Steam enters head of heater and circulates through a series of copper tubes. Heated water rises through a separate hot-water pipe into tank. *Rockwood Sprinkler Co, 38 Harlow St, Worcester, Mass.*

4 SELF-LOCKING SCREW THREAD—"Relieved Profile" thread has root of each bolt thread stepped at midpoint and each step is tapered 6 deg with axis of screw. Lower step is undercut 0.003 to 0.005 in., depending on nominal thread diameter, in contrast to original Dardelet thread which has continuous tapered slope on bolt thread root without any step. Clearance exists between assembled bolt and nut threads, permitting limited axial displacement which provides for change in relative thread positions from unlocked to locked. *Dardelet Threadlock Corp, New York, N. Y.*

5 SET SCREWS—Cup-point set screws have knurling all around points. When turned into place, knurled edges grip shaft in such manner that loosening or backing off is said to be impossible except by applying wrench. Screws may be reused in same holes. *Standard Pressed Steel Co, Jenkintown, Pa.*

6 OIL TUBING—"Resistoflex PVA tubing for oils and solvents, made of flexible synthetic resin, is claimed insoluble in gasoline, oil, ethers, alcohol, etc. Physical characteristics include lightness (specific gravity of about 1.26), toughness, elasticity, and high flexibility. *Resistoflex Corp, 370 Lexington Ave, New York, N. Y.*

7 PHONE BOOTHS—Acoustic phone booths, for limited space and noisy locations, are made in two models. No. 301 is bolted to wall or pillar; No. 401 rests on bench or desk. Special lining of perforated metal backed by soft sound-absorbent material prevents interference with telephone user. *Acoustic Div, Burgess Battery Co, Chicago, Ill.*

8 SALT-TABLET DISPENSER — Improved salt-tablet dispenser is compact all-metal cylinder fitted with convenient wall bracket for mounting at drinking fountains. Alumilite, a special corrosive-free metal, guards against chemical reaction between salt and metal. *Morton Salt Co, Chicago, Ill.*

VIBRATION INSULATOR—Addition to "Vibro-Insulator" line of metal-to-rubber mountings, Type 30 is made of a rubber compound having low permanent set. Loaded in shear, will carry load of 30 lb; in compression, load of 120 lb. In either case, deflection is ⅜ in., providing for a minimum machine frequency of 925 per min. For mounting air compressors, refrigerating units, etc. *B F Goodrich Co, Akron, Ohio.*

FRICTION TAPE—Addition to regular "Slipknot" black friction tape is known as Slipknot brown. Manufacturer claims that it is first basic improvement in tape industry in many years and that this tape has longer life than most tapes now in existence. *Plymouth Rubber Co, Inc, Canton, Mass.*

EYE PROTECTION—"Snopake" reduces excessive glare experienced during winter months in buildings adjacent to open fields where large expanses of snow may be present. Product is a pale-green adhesive liquid applied to inside or outside of window and remains on glass until removed with hot water and stiff bristle brush. Admits over 90% of light, yet reduces it to softly diffused illumination. *Skybryte Co, Cleveland, Ohio.*

FIRE-EXTINGUISHER HANDWHEEL — Improved handwheel of "Lux" fire extinguisher gives better grip, more leverage and is easier to operate. Has a pull-out pin which is kept in tension at all times to assure positive sealing. *Walter Kidde & Co, 140 Cedar St, New York, N. Y.*

TELEPHONE SYSTEM—For three or four phones up to several hundred. No batteries or other power source needed to operate speaking circuit; sole source of power lies in vibrations of speaker's voice. These actuate diaphragm of telephone, which, in moving, creates voice current which travels over wire to receiving phone, where it is converted back into original vocal tones. *Telephone Systems Co, 120 Greenwich St, New York, N. Y.*

AIR-LINE FREEZE PREVENTATIVE — "Frosto" is vaporized and fed into compressed-air lines near compressor as fast as necessary to prevent freezing of water vapor in lines and tools. Only about one quart is required to treat 100,000 cu ft of free air under worst conditions of temperature and humidity. *Sullivan Machinery Co, Michigan City, Ind.*

FIRE PROTECTION—"Fire-Fog" nozzle, for protecting outdoor electrical equipment, is designed so that a central solid jet of water meets a twisting, convergent current of water to produce a uniformly solid cone of finely divided spray at low nozzle pressures. It is claimed that a burning liquid, such as transformer oil, is cooled below flash point, blanketed with a continuous spray of water, and that steam is formed in sufficient quantity to dilute flammable vapors and exclude air necessary for combustion. *Walter Kidde & Co, 140 Cedar St, New York, N. Y.*

INSULATION FOR UNDERGROUND STEAM LINES—"ADSCO-Corning" filler insulation is composed of long flexible fibres of glass in a soft resilient mass resembling cotton batting, but possessing permanence and chemical characteristics inherent in glass. Has high thermal efficiency, low conductivity rate of 0.33 at 4 lb density, fluffs under vibration, is fireproof, unaffected by water, acids or fumes, and will not corrode pipes in presence of water. *American Dist. Steam Co, North Tonawanda, N. Y.*

SPRAY CLEANERS—Models J and K of "Hypressure Jenny" steam-vapor spray cleaners remove, oil, dust, grease and dirt from motors, machinery, etc. Model J is a portable, automatic unit with electric ignition and nozzle control. Is instant starting, has pressure-atomizing fuel-oil burner with all accessories mounted in end panel. Operates at pressures up to 150 lb. Model K is stationary, continuous vapor-flow unit with manually ignited kerosene burner. Operates at pressures up to 110 lb. *Homestead Valve Mfg. Co, Coraopolis, Pa.*

CORROSION-RESISTANT ALLOY — "Z" nickel combines strength of steel and corrosion resistance of nickel. It contains 98% nickel and can be heat treated to as high a hardness as 46 Rockwell C and tensile strength 250,000 lb per sq in. Furnished as hot-rolled rod, cold-rolled rod, wire and strip. Can be prequenched for hardening if desired. *International Nickel Co, 67 Wall St, New York, N. Y.*

ACID-PROOF CEMENT—For chemical and metallurgical industries, public works and utilities, three acid-proof cements bond and repair masonry structures handling acid gas, fumes, vapors, acid solutions, etc. Gray cement withstands temperatures up to 2400 F; black and quick-setting black cements to 1200 F. *Quigley Co, 56 W 45th St, New York, N. Y.*

INSULATING CEMENT—No. 1 insulating cement for boilers, drums, ducts, valves, breechings, etc, is effective up to 1800 F. Applied on clean surface, it adheres immediately, forming continuous blanket of insulation without joints. When equipment is to be replaced, cement can be removed, mixed with water and reused. *Baldwin-Hill Co, 514 Klagg Ave, Trenton, N. J.*

MOTORS, SWITCHES AND OTHER ELECTRICAL EQUIPMENT

1 BATTERY CHARGER—Heavy-duty rectifier battery charger can be mounted in any convenient position, or with rubber-tired wheels. Mounted above transformer, on top of base, is 3-gang centrifugal blower driven by ball-bearing motor. This blower propels air at relatively high velocity through radiating fins of three rectifier stacks. Average charging rate of about 100 amp for lead-acid storage battery of 16 cells, or nickel-iron battery of 25 cells. Operates on 3-phase, 220-volt current. *B-L Electric Mfg Co, St. Louis, Mo.*

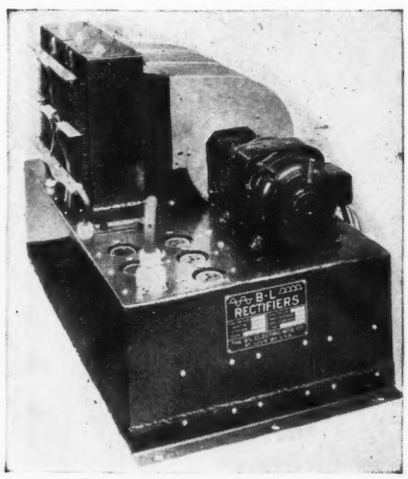
2 RENEWABLE FUSE—Both ends of fuse have series of small holes through which air circulates. As an additional safeguard to prevent flames escaping in case of a blow, both fuse ends have series of fine-mesh screens through which air must pass. There are only two parts and link, making for quick renewal when fuse blows. *Pierce Renewable Fuses, Inc, Buffalo, N. Y.*

3 SPLASH-PROOF MOTOR—Line of splash-proof motors of cast-iron construction has specially impregnated windings. Baffling system prevents entrance of water or falling particles; ventilation system assures low temperature rise. Sealed ball bearings are accessible for lubrication in all mounting positions. Line conforms to NEMA specifications. *Diehl Mfg Co, Elizabethport, N. J.*

4 FAN MOTOR—Shaped to blend with usual fan or air-circulator design. Has barrel frame to faciliate mounting in ring or yoke. Built with split-phase windings, for 1150 or 1725 rpm with start-and-stop pull switch; with windings for two speeds, 860 and 1140 or 1140 and 1725 rpm with 3-position pull switch; also to operate with separate transformer capacitor control to run at two or three speeds. Made in sizes ⅛, 1/6 or ¼ hp to operate fans from 20 to 32 in. in diameter. *Ohio Electric Mfg Co, 5914 Maurice Ave, Cleveland, Ohio.*

5 ADJUSTABLE-SPEED AC MOTOR—Well-known principles are combined and applied to produce 3-phase motor having characteristics resembling those of a dc motor with variable-voltage control. Features include: Regulation from standstill to 150% of synchronous speed without rheostatic losses; operation on full field, which gives full torque over entire speed range; speed is practically independent of load; full-voltage starting; dynamic braking; remote and automatic speed control if desired. *Crocker-Wheeler Electric Mfg Co, Ampere, N. J.*

6 POLYPHASE MOTOR—Type RT polyphase motor has low starting current, high starting torque, and good speed regulation. Rotor is primary member and carries winding which is connected to line when motor is operating. Secondary member is stator and has two windings, one of which is high-resistance short-circuited winding and other is low-resistance insulated winding. Ordinarily made in sizes 40 hp and larger. *Wagner Electric Corp, 6400 Plymouth Ave, St. Louis, Mo.*



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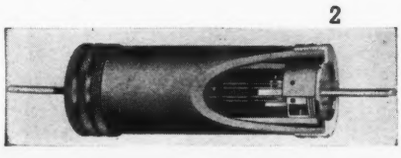
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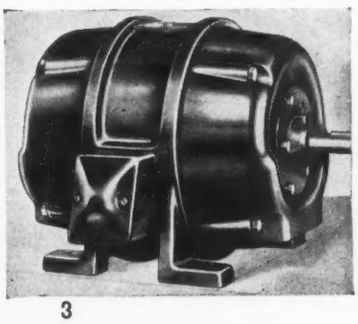
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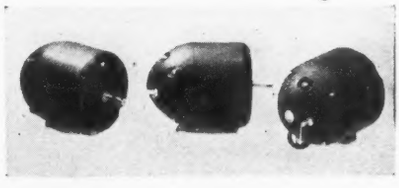
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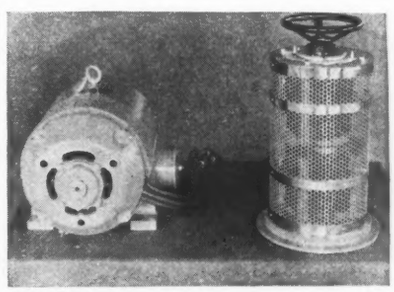
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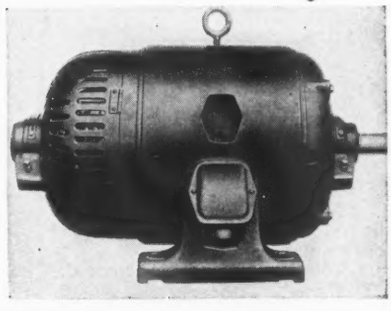
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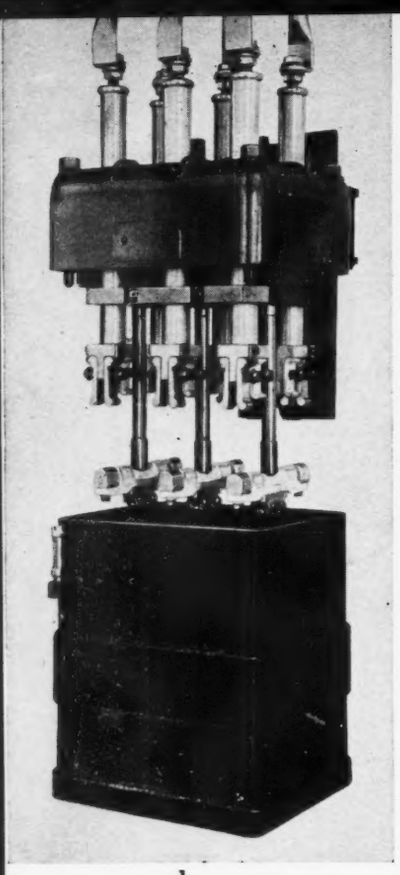

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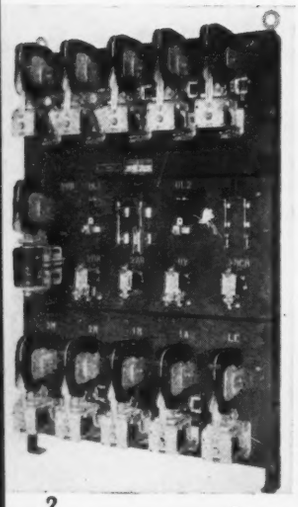

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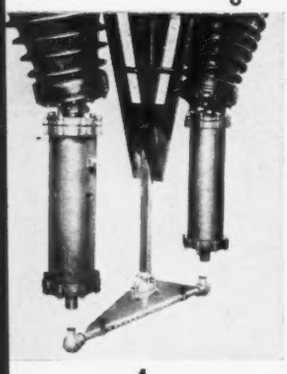

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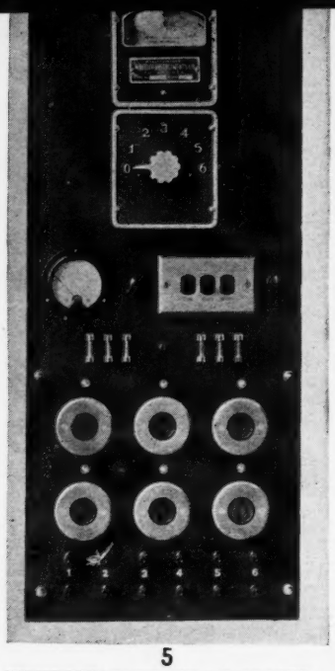

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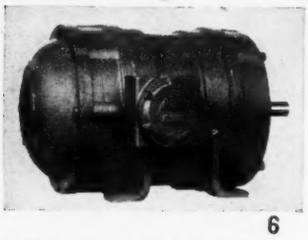

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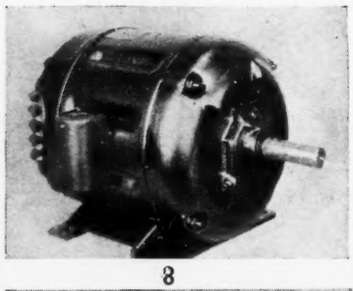

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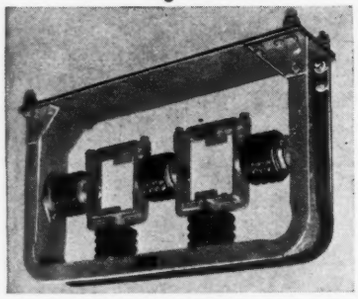

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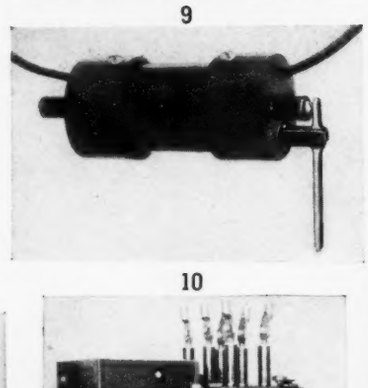

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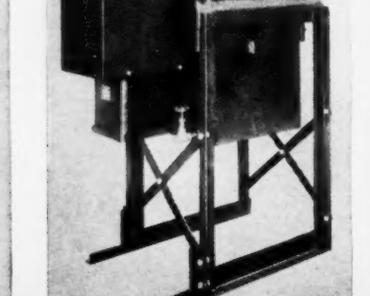

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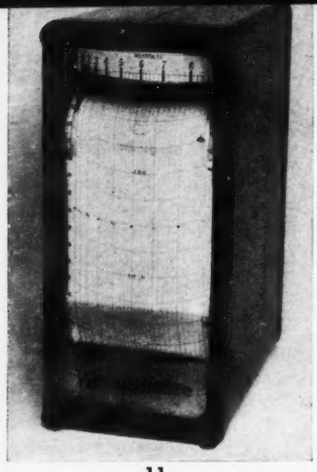

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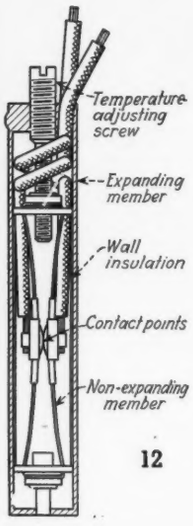

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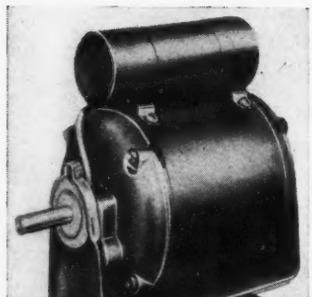

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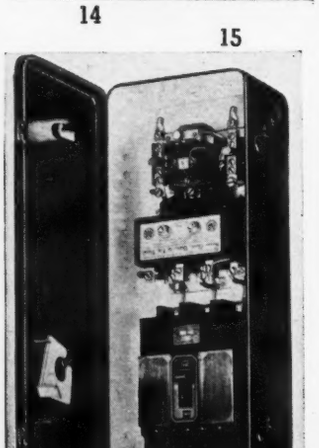

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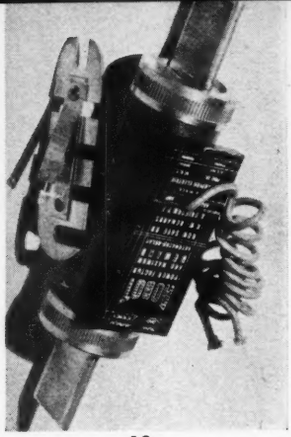

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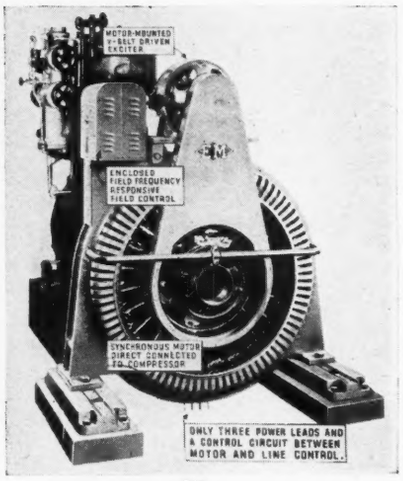
MOTOR-MOUNTED V-BELT DRIVEN EXCITER
ENCLOSED FIELD FREQUENCY RESPONSIVE FIELD CONTROL
SYNCHRONOUS MOTOR DIRECT CONNECTED TO COMPRESSOR
ONLY THREE POWER LEADS AND A CONTROL CIRCUIT BETWEEN MOTOR AND LINE CONTROL.

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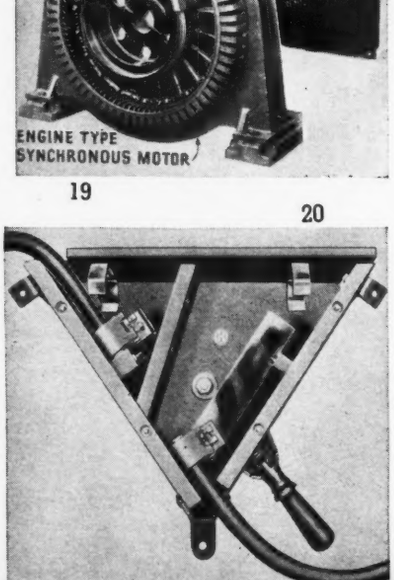
ENCLOSED WALL-MOUNTED CONTROL FOR SYNCHRONOUS MOTOR
MOTOR MOUNTED V-BELT DRIVEN EXCITER
FIELD CONTROL UNIT
LINE-CONTROL UNIT
ENGINE TYPE SYNCHRONOUS MOTOR

19

20

1 CIRCUIT BREAKER—Type DX-25 moderate capacity indoor oil circuit breaker. Expulsion ports are claimed to hasten arc extinction. Self-aligning, wedge-and-finger contact with silver surfaces on main contacts; cast-steel top frame, electrically welded steel tank; flat-angle, straight-line-motion mechanism. Manually or electrically operated for 600, 1200 and 2000 amps at 15,000, 7500 and 5000 volts respectively. Interrupting capacity of 75,000 kva. *Allis-Chalmers Mfg Co, Condit Works, Boston, Mass.*

2 CRANE-HOIST CONTROL—Dc crane-hoist control has rocker-bearing contactors and magnetic time relays, high lowering speeds, good speed regulation. Low power consumption because regenerative braking is obtained for any load requiring 30% or greater braking effort. Dynamic braking available for emergency stops in case of solenoid-brake failure. Automatic control of deceleration by magnetic time relay provides safe stopping. *General Electric Co, Schenectady, N.Y.*

3 MULTIBREAK INTERRUPTER—Recently subjected to interrupting tests on 138- and 230-kv systems, new GE interrupters consistently cleared short circuits as high as 2,000,000 kva in less than 5 cycles. This interrupting device uses oil-blast principle. Pressure created by arc forces oil across arc and out through ports in cylindrical housing. Tests disclosed that six breaks per terminal for 230-kv, and four for 138-kv service, were adequate. *General Electric Co, Schenectady, N.Y.*

4 SAFETY SWITCH—Mill-duty safety switch has 3/16-in. shatter-proof glass window and sponge-rubber gasket to cushion glass and seal opening in cover. Quick make and break, pressure-type fuse clamps, non-current-carrying fuse posts, double-break air-blanketed contacts, silver-plated blades and jaws. Sizes from 30 to 1200 amps, 600 volts, fusible and non fusible. *Cutler-Hammer Inc, Milwaukee, Wis.*

5 TEST PANEL—For small electrical equipment, this device tests internal or surface temperature up to 800 F, resistance from 0 to 1000 ohms; makes continuity current readings on milliammeter as low as 10 milliamps. Also indicates current flow, tests for shorts, permits visual observation of thermostats, etc. *Wheelco Instruments Co, 1929 S Halsted St, Chicago, Ill.*

6 SQUIRREL-CAGE MOTOR — Explosion-proof Type AA ac motors have been tested and approved by Underwriters' Labs for Class 1, Group D hazardous locations. All working parts completely enclosed. Housing is strong enough to withstand even internal explosion without bursting. *Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland, Ohio.*

7 SINGLE-PHASE MOTOR—Type RG integral-horsepower, repulsion-induction, single-phase motor has electrical characteristics suitable for operating air compressors, viscous-liquid pumps, refrigerant compressors, conveyors, etc. Features are: high starting torque, low starting current, positive starting on low voltage, high power factor. Made in sizes 1 to 3 hp. *Wagner Electric Corp, 6400 Plymouth Ave, St. Louis, Mo.*

8 BUS SUPPORT—Two sets of twelve 6 x ¼ in. bars, with wide spacing between groups of six are carried on wet-process insulators in compression. Clamps, with rollers and springs, permit bus expansion and contraction. Steel frame is held on bottom of floor beams by ⅜-in. bolts and beam grips. Adjusting nuts between frame and end insulators insure rigidity of supports. *Delta-Star Electric Co, Chicago, Ill.*

9 ELECTRICAL CONTACT—Movement required to open or close contact is $\frac{1}{64}$ in. where pressure is put directly against contact plunger. A pressure of 5 oz. is required, although contacts for lighter pressure can be made. Where lever is used, pressure required at lever end is about 1½ oz. While this contact is said to be particularly applicable to fractional-hp and solenoid requirements, it will handle safely 30 amp at 110 volts or 15 amp at 220 volts ac. *Robert Hetherington & Son, Sharon Hill, Pa.*

10 CIRCUIT BREAKER—100,000-kva interrupting rating indoor oil circuit breaker, Type FK-46, incorporates single-port, cross-blast principle with heavy-duty butt-type arcing contacts and silver-to-silver main current-carrying contacts. May be operated either manually or electrically and interrupts circuit within 8 cycles (0.133 sec). *General Electric Co, Schenectady, N. Y.*

11 VOLTMETER, AMMETER—G-40 recording instrument has broad line of movements to meet all conventional requirements in central-station and industrial field. Dc voltmeter, ammeter, millivoltmeter and milliameter elements operate on permanent-magnet, moving-coil principle. Single-phase wattmeter, voltmeter and ammeter elements are iron-clad, iron-core, single-element dynamometers. *Westingbouse Elect & Mfg Co, E Pittsburgh.*

12 CARTRIDGE SWITCH—Thermoswitch has adjustable operating range of 0 to 400 F. Outer shell is thermo-responsive element. Parts that carry contacts are thermally inert and arranged so that contacts are firmly pressed together while closed. As contacts are sealed within shell, several breaks decrease oxygen tension to eliminate further oxidation, and tendency of arcing in remaining inert gas is nil. Current rating: 10 amp, 110 volts ac. *Fenwal Inc, Ashland, Mass.*

13 BELT-TIGHTENING MOTOR—Belt-tightening unit for overdrives is supported above and off shaft center so its own weight provides initial belt-tightening effect. However, this is increased proportionately to load by reaction of rotor to stator, causing motor to swing away from its load and tighten belt proper amount. Also made as belt tightener without springs for underdrive belts. *Ohio Electric Mfg Co, 5914 Maurice Ave, Cleveland.*

14 DOUBLE-CAPACITOR MOTOR—High-torque, double-capacitor motor is designated as Type RZN when equipped with rigid mountings and Type RZNR with annular resilient mountings. Made for 110/220 volts, in 1/3, ½, ¾ and 1 hp ratings. Has two capacitors of different value—a high value for starting and a low value for running. Change in capacitance occurs at about 75% full-load speed through a centrifugal switch on motor. *Wagner Electric Corp, 6400 Plymouth Ave, St. Louis.*

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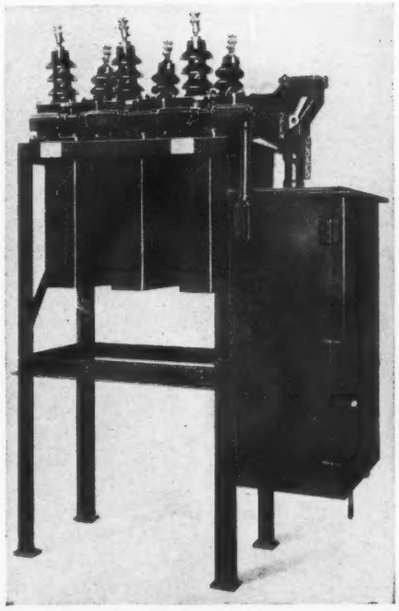


15 STARTING-SWITCH CIRCUIT BREAKER—Combination starter utilizing circuit breakers has hand-operated disconnect switch and automatic starter. Standard disconnect switch has been replaced by circuit breakers with maximum rating of 30 hp, 220 volts; 50 hp, 440-550 volts. Solenoid automatic starting switch has double-break silver-alloy contacts and two thermal overload relays. *Allen-Bradley Co, 1311 S First St, Milwaukee, Wis.*

16 FUSES WITH ALARM—"Robot" fuses now available in all knife-blade terminal sizes from 61 to 600 amp and voltages up to 600, as well as in smaller ratings. These refillable fuses have an element to which is attached a bimetallic stripe. As temperature of fuse link increases with load, one end of strip moves away from link to close contact and give alarm at predetermined load. *Champion Electric Fuse Co, 784 Broadway, New York, N.Y.*

17 MOTOR DRIVE—Packaged synchronous-motor drive for reciprocating compressors such as used in air-conditioning refrigeration, said to simplify wiring and installation, and reduce amount of floor space required. Field-control equipment for synchronous motor, as well as exciter, is mounted on top of motor. Motor can thus be shipped with all wiring complete between motor, exciter and field control. *Electric Machinery Mfg Co, Minneapolis.*

18 ELECTROSTATIC VOLTMETER — Portable electrostatic voltmeter for measurement of ac or dc voltage on systems where one line is grounded, is made in ratings of 3, 5, 10, 15, and 20 kilovolts. Features include light-beam pointer, magnetic dampening, and high-voltage terminal with current-limiting resistor. Accuracy of 2% full-scale is maintained in all ratings, when used on either ac or dc. up to 700 cycles per sec. *General Electric Co, Schenectady, N. Y.*

19 COMPRESSOR MOTOR—Designed to make direct-connected synchronous motors more practical for smaller industrial reciprocating compressors down to 40 hp. Motor-mounted exciter eliminates need for floor space and extra wiring. Line-control unit magnetic, full voltage with overload and undervoltage protection. Field-control unit is slip-frequency responsive type for automatically applying and removing motor field excitation. *Electric Machinery Mfg Co, Minneapolis, Minn.*

20 SAFETY FEEDER SWITCH—Low-capacity feeder safety switch is of quick-make, quick-break type, for 250-600 volts in 300- and 400-amp sizes. Enclosed in fireproof case. Heavy rubber handle gives further protection. Action of connecting and disconnecting switch is instantaneous and quick make insures positive contact when switch is closed. *Ohio Brass Co, Mansfield, Ohio.*

21 SWITCHBOARD WIRE—"Deltabeston" switchboard wire is insulated with a new synthetic compound that can be easily bent at sharp angles without rupture to insulation, which is applied directly to tinned copper conductor to form a seamless tube. Pure asbestos is then felted around compound and a woven braid added that is impregnated with a flame-resisting compound. *General Electric Co, Schenectady, N.Y.*

22 CIRCUIT BREAKER—Type OZ-110 moderate capacity outdoor oil-circuit breaker. Special interrupting "Ruptors" give quick clearing of short circuits, and unit has low arc energy, low pressure, and minimum oil deterioration. For 600 amp at 15 kv, with interrupting capacity rating of 100,000 kva. *Allis-Chalmers Mfg Co, Condit Works, Boston.*

1 CIRCUIT BREAKER—Type AE-1A air circuit breaker has interrupting rating of 10,000 amp. Made in ratings of 600 volts ac; 250 volts dc; 15—225 amp. System of arc quencher and barriers prevents arcs from occurring between contacts and steel enclosing cover. Offered in single-, double-, triple- and 4-pole units. Manual or electrical operation, for live-front and dead-front switchboard mounting. *General Electric Co, Schenectady, N.Y.*

2 CONSTANT-CURRENT REGULATOR—Station-type constant-current regulator made in 2 models. Type RS, non automatic, is designed to operate in an indoor substation with manually operated control panel. It will regulate from full load to no load within 1%, plus or minus, of rated secondary current when operated at rated primary voltage and frequency and on unit-power-factor load. Type RZ fully automatic regulator designed primarily for unattended substation, but can be used indoors. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*

3 STUD MOLE—Type ZMLD stud mole is a combined insulated multiple terminal and bushing for network protectors used in underground distribution. Is designed to provide multiple connections in small space and to seal out moisture and gas encountered in underground vaults. Can be used with all types of cables, and for making multiple terminal connections on distribution transformers. *Burndy Engineering Co, 459 E 133rd St, New York, N.Y.*

4 BAR-TO-BAR TEST SET—Portable test set for dc armatures is plugged in to any convenient 115-volt, 60-cycle outlet. Leads from 4 binding posts are attached to commutator, two furnishing current supply to resistance being tested, and two being terminals of drop circuit, leading to galvanometer. To compare resistance between different bars, two particular ones are chosen and instrument set for 100% deflection by adjusting "current", "range" and "sensitivity" rheostats until desired deflection of light-beam galvanometer is obtained. *General Electric Co, Schenectady, N.Y.*

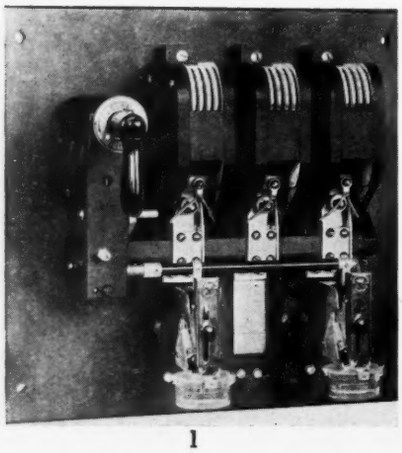
5 FUSES—Two "Robot" fuses: "Floating Power" fuse protects motors against momentary abnormal starting currents, reduced normal running currents, and variable load requirements. "SOS" fuse, in combination with first fuse element and signal pilot, automatically signals over-load, peak loads, and approximate demand of light and power circuits. *Champion Electric Fuse Co, 684 Broadway, New York, N.Y.*

6 VOLTAGE REGULATOR — "Silverstat" regulator for automatic voltage control of small ac and dc generators is of direct and quick-acting, rheostatic type, and regulates voltage by varying directly resistance in field circuit. Few moving parts are permanently supported by leaf springs; no pivots or similar bearings to wear and work loose. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*

7 MULTI-RANGE VOLTMETER—Portable Model 433 ac voltmeter has improved temperature compensation. Double-range instruments (300/150 volts) and triple-range (600/300/150 volts) are made with improved compensation which holds temperature errors to 1% for 60 C on both 250- and 300-volt ranges and to 1% for 240 C on 600-volt range. Due to special internal connections, switches are used for range changing. *Weston Electrical Instrument Corp, Newark, N.J.*

8 CLAMP CONNECTOR—Type KPF clamp consists of a cast copper body through the bottom of which a hole is tapped. A ½-in. bolt passes through hole in copper bar and into tapped-body hole where it forces pressure bar against cable. Accomodates a range of cables and can be pivoted upon bolt to permit cable tap-off at any angle from bar. *Burndy Engineering Co, Inc, 459 E 133rd St, New York, N.Y.*

9 OVERLOAD RELAY—For either ac or dc, this relay has contacts rated 30 amp at 110



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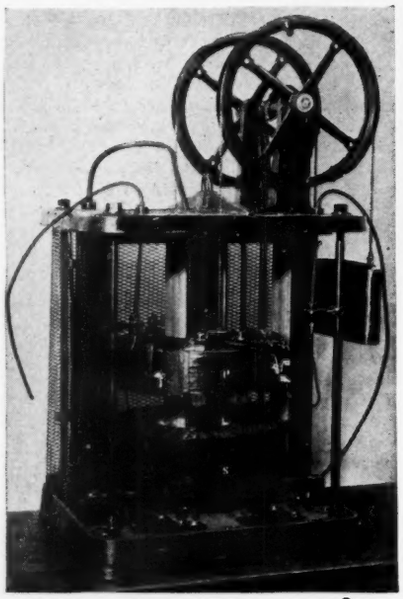

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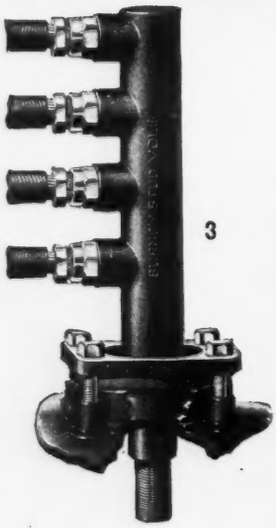

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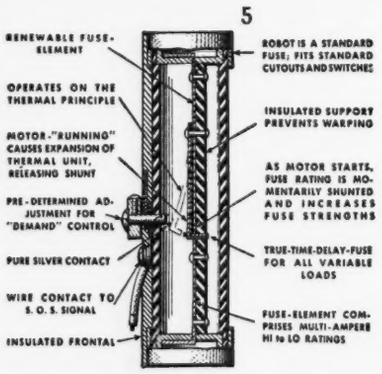
RENEWABLE FUSE-ELEMENT
OPERATES ON THE THERMAL PRINCIPLE
MOTOR-"RUNNING" CAUSES EXPANSION OF THERMAL UNIT, RELEASING SHUNT
PRE-DETERMINED ADJUSTMENT FOR "DEMAND" CONTROL
PURE SILVER CONTACT
WIRE CONTACT TO S. O. S. SIGNAL
INSULATED FRONTAL
ROBOT IS A STANDARD FUSE; FITS STANDARD CUTOUTS AND SWITCHES
INSULATED SUPPORT PREVENTS WARPING
AS MOTOR STARTS, FUSE RATING IS MOMENTARILY SHUNTED AND INCREASES FUSE STRENGTHS
TRUE-TIME-DELAY-FUSE FOR ALL VARIABLE LOADS
FUSE-ELEMENT COMPRISES MULTI-AMPERE HI to LO RATINGS

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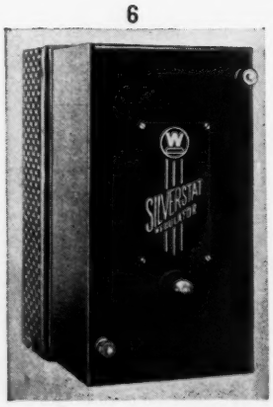

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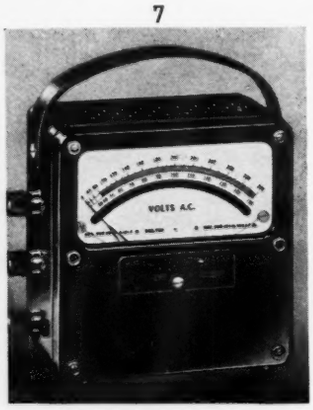

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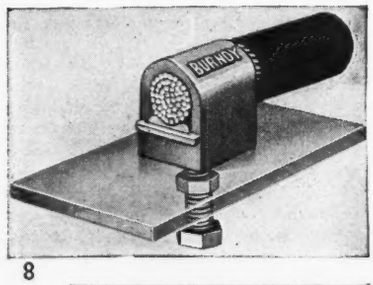

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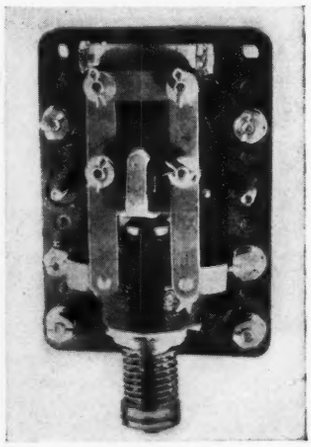

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volts ac, 20 amp at 220 volts ac, 6 amp at 110 volts dc, and 3 amp at 230 volts dc on non-inductive loads. Is somewhat similar to line of mechanical latch-in electrical reset relays. Contacts can be opened manually or by voltage-operated coil. Latch is adjusted to pick up and open contacts when current in overload coil reaches proper value. *Struthers Dunn Inc, 139 N Juniper St, Philadelphia, Pa.*

10 TRANSFORMER—Type JW-1, 5000-volt indoor current transformer replaces Model WF-12. Accuracy of new JW-1 conforms to NEMA rating of ¼X, ¼Y, and ¼Z at 60 cycles. Formed fibre caps cover end of core, obtaining high flashover value without increasing dimensions. Sufficient space is provided for tapping primary terminals with an anchoring overlap on transformer insulation. Secondary short-circuiting switch is designed to afford positive and visible contact. *General Electric Co, Schenectady, N.Y.*

11 GEAR-SHIFT MOTOR—Has 4 speeds, three forward and one reverse, actuated by shift lever. All steel, heat-treated gears, which run in oil bath; special oil-seal closures. Heavy cast-iron mounting bracket assures rigid support for entire unit. Made as single-speed unit, 1200 rpm, or 2-speed, 1200/600 rpm. *Lima Armature Works Inc, Lima, Ohio.*

12 CURRENT-LIMITING FUSE—Type EJ-1 high-voltage power fuse is said to limit short-circuit current to value substantially below that usually encountered in short-circuit interruptions. Fuse consists of an interrupting element of one or more silver wires wound on a supporting core of high-temperature ceramic material, and imbedded in an interrupting medium of granular quartz. A target wire welded to upper connection strip passes through center of core and terminates in a chamber at bottom containing a small quanity of gas-producing chemical. *General Electric Co, Schenectady, N.Y.*

13 SUSPENSION INSULATOR—Two rugged suspension insulators, one of petticoat design (shown in illustration) and one with smooth disk, have high impact resistance to minimize breakage. Both types have 10-in. disk and 15,000-lb M&E rating, and either 5- or 5¾-in. spacing. 5-in. units have socket cap and ball pin; other, either socket cap and ball pin or clevis cap and pin. *Ohio Brass Co, Mansfield, Ohio.*

14 FOG-PROOF INSULATOR—Fog-and-contamination-proof suspension insulator has inner and outer petticoating. Shell has 10-in. diameter and 4-in. droop, allowing liberal clearance between adjacent units spaced at 6½ in. This prevents sparking from cap of one insulator to flange immediately above or below it. Made with socket cap and ball pin or clevis cap and pin. *Ohio Brass Co, Mansfield, Ohio.*

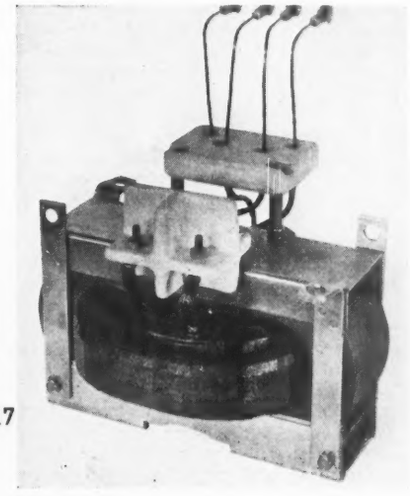
15 OUT-OF-STEP RELAY—Type GDL relay for motors or generators where electrical center of system is sure to be inside machine. Operates on principle that current magnitude increases until machine is 180 deg out of step, at which point watts flow reverses, changing machine from motor to generator, or vice versa. When current decreases to 0 deg, watts reverse again. Detecting these functions by use of an instantaneous plunger-type overcurrent relay and fast watt-metric relay makes possible an out-of-step relay. *General Electric Co, Schenectady, N.Y.*

16 HIGH-SPEED RELAY—Type HDD percentage differential relay for transformer protection effects combination of harmonic and percentage restraint principles. Two types made: HDD11A for 2-winding transformer protection, and HDD11B for 3-winding transformers. Both are mounted in standard universal cases, 5½ x 16 in., suitable for flat-surface or semiflush mounting. *General Electric Co, Schenectady, N.Y.*

17 WOUND-CORE TRANSFORMER—Feature is core construction of two continuous strips of relatively low silicon-content cold-rolled steel, tightly wound onto two metal rings around coils. Coils are oval in shape and of short axial length, interleaved in secondary-primary-secondary arrangement. Significance of this transformer is that it eliminates cutting and placing of hundreds of separate pieces of steel that make up core of usual transformer. *General Electric Co, Schenectady, N.Y.*

18 RESISTOR—Hermetically sealed precision resistors are non-inductively pie-wound on porcelain in 2, 4, 6, or 8 sections, and enclosed in strong tubes. 1 watt rating—1% accurate (or closer tolerance when required). Resistances range from 0.1 ohm to 2 megohms. *Ohmite Mfg Co, 4835 Flournoy St, Chicago, Ill.*

19 REVERSING SWITCH, AIR CIRCUIT BREAKER—Magnetic reversing switch combined with air circuit breaker is particularly suitable for short-circuit protection for individual motors and as means of disconnecting power-supply line to switch and motor. Complete device consists of an air circuit breaker, two magnetic contactors mechanically interlocked, and a temperature overload relay. *General Electric Co, Schenectady, N.Y.*



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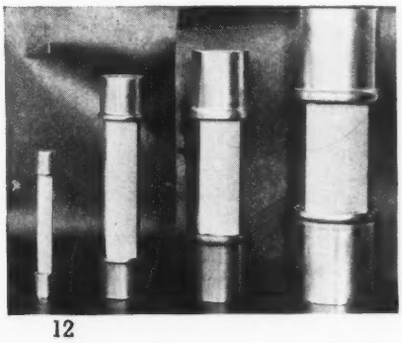

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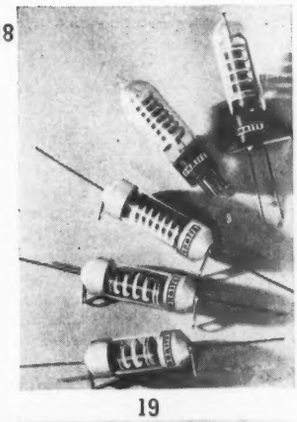

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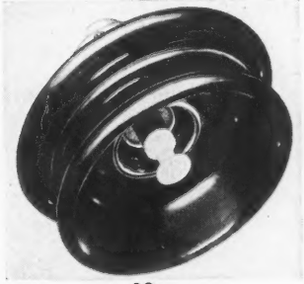

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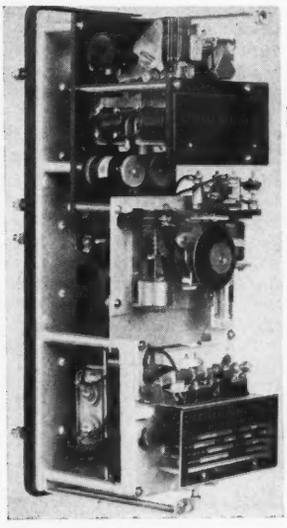

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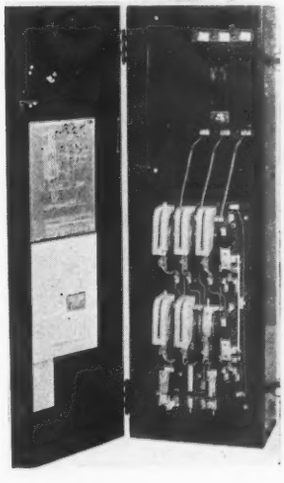

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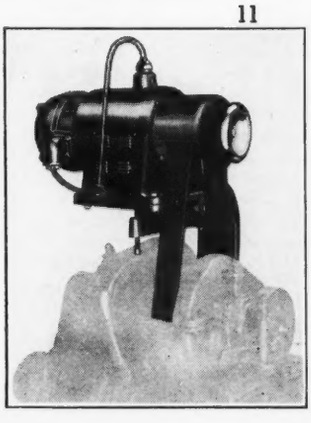
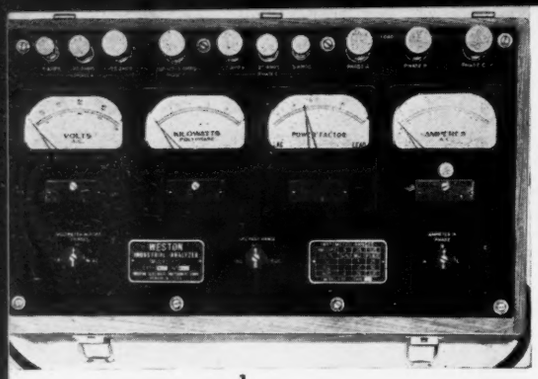
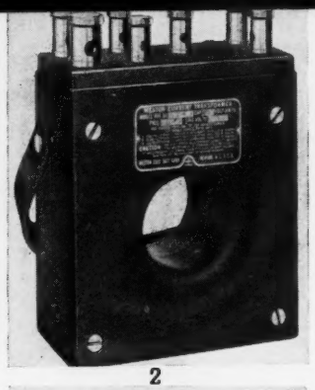




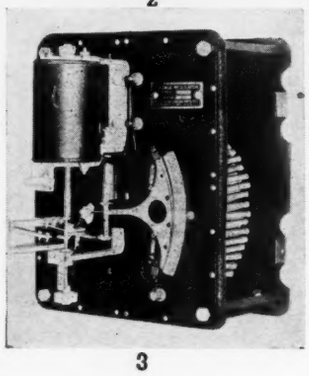
1

1 ANALYZER—Model 639 industrial analyzer permits analysis of plant conditions. It combines four ac instruments: voltmeter, wattmeter, power-factor meter and ammeter in an oak carrying case, and is designed for measuring current, voltage, power and power factor in single and polyphase circuits. Connections necessary when making tests are claimed to have been greatly simplified. *Weston Electrical Instrument Co, Newark, N.J.*



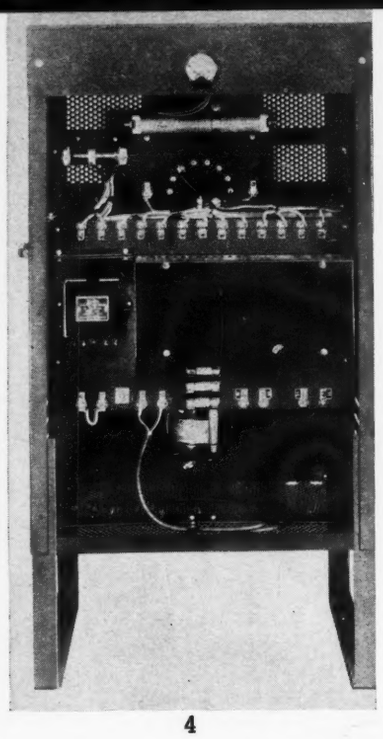
2

2 PORTABLE TRANSFORMER—Model 461, Type 2, portable current transformer embraces primary current ranges from 10 to 800 amp and has normal secondary capacity of 15 volt-amps. This unit has a short-circuiting switch for secondary winding to prevent damage to transformer if secondary circuit should be opened while current is on in primary. *Weston Electrical Instrument Corp, Newark, N.J.*



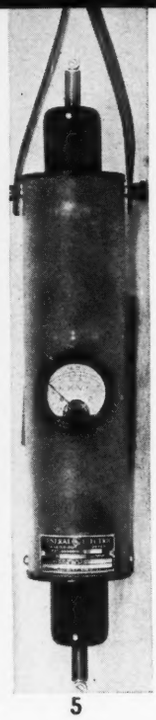
3

3 VOLTAGE REGULATOR—Type V-O rocking-contact voltage regulator, designed for automatic voltage control of small ac and dc generators, is quick acting, regulating voltage by directly varying resistance in field circuit. Consists of a sensitive solenoid-actuated plunger that acts upon a main shaft, rocking a special carbon-rimmed contactor sector over inner surface of a commutator, segments of which are connected permanently to regulating resistance. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*



4

4 BATTERY CHARGER—Automatic charger for batteries used for control bus (oil-switch operation, emergency lighting, etc), consists of fan-cooled copper-oxide rectifier controlled by relay, an accurate electro-magnetic contacting device, self-compensating for ambient temperature variations. Through synchronous time switch, rectifier automatically puts battery on charge at definite intervals. *Electric Storage Battery Co, Allegheny Ave & 19th St, Philadelphia, Pa.*



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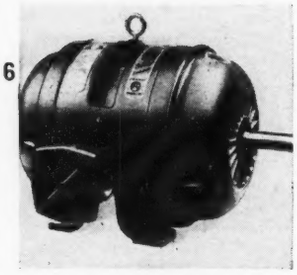
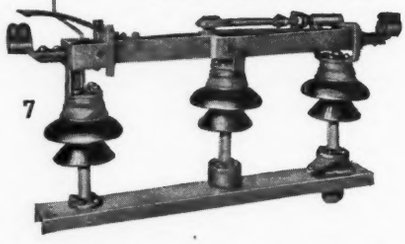
5 PHASING-OUT VOLTMETER — Portable high-resistance voltmeter consists of an instrument connected in series with small neon lamp and two high-voltage resistors that are treated to assure stability and immunity to effects of varying atmospheric conditions. A transparent plastic tube houses component parts. Indicating instrument is a rectifier-type milliammeter. *General Electric Co, Schenectady, N. Y.*



6

6 EXPLOSION-PROOF MOTOR—Line of explosion-proof, ball-bearing motors has been approved by Underwriters' Labs for Class I Group D hazardous locations. Double-end ventilation assures positive cooling from both ends of motor and eliminates hot spots. Cartridge-type sealed ball bearings; double-box frame construction. *Fairbanks, Morse & Co, 600 S Michigan, Chicago, Ill.*



7

7 AIR-BREAK SWITCH—Model 8400 air-break switch has as basic principle changing a parallelogram whose angles are other than 90 deg to a rectangle. In changing blade parallelogram into rectangle, one blade travels backwards while other travels forward, first wiping off contact surfaces. 7.5 to 69 kilovolts; 400 to 1200 amp. *Electrical Engineers Equipment Co, Melrose Park, Ill.*

SECONDARY FUSE—Outdoor indicating secondary fuse is for transformer secondary protection or banking, and isolating service-entrance faults. Corrosion-resisting materials are used throughout and fuse link is enclosed in weather-tight housing of Textolite. Internal fuse assembly is held under constant tension by compression spring that exerts outward pressure on retaining collars. *General Electric Co, Schenectady, N.Y.*

THERMAL PLUG FUSE—"Trico-Matic" thermal time-lag fuse is former "colortop" plug fuse to which has been added a built-in thermal overload cut-out which holds starting and momentary overloads. Other features are: all-porcelain shock- and vent-proof top, a flag indicator when blown, large ampere rating on window, flat releasing spring under copper link giving maximum travel in opening arc when blown. *Trico Fuse Mfg Co, 5th St at Chambers, Milwaukee, Wis.*

AC GENERATORS—Addition to line of ac generators gives manufacturer size range of 1½ to 300 kva for direct connection to gas, diesel or gasoline engines. Either direct-connected exciters or external dc excitation. Where generators are furnished with direct-connected exciters, a special compounding, automatic voltage adjuster is available that will maintain voltage within plus or minus 5% for average load conditions. *Columbia Elect Mfg Co, 4519 Hamilton Ave, Cleveland, Ohio.*

INSULATING TAPES—Electrical insulating tapes, woven entirely from glass yarns, have appearance and flexibility of ordinary textiles. Intended for insulation of coils for motors, generators, transformers, etc. They impregnate readily with resins, gums and varnishes to form an insulation impervious to moisture and of high dielectric strength. *Corning Glass Works, Fibre Products Div, Corning, N. Y.*

CIRCUIT BREAKER—"Dulbrak" circuit breaker for 125 volts ac or dc in capacities from 6 to 50 amp has bimetallic thermal breaker. Is trip free, non-closeable on short circuit or heavy overloads. Incorporates positive double-break contacts with low-arcing, quick-make-and-break action. When a circuit is automatically interrupted, red-dot signal button pushes out beyond face of unit and handle remains at ON position. *Frank Adam Electric Co, St. Louis, Mo.*

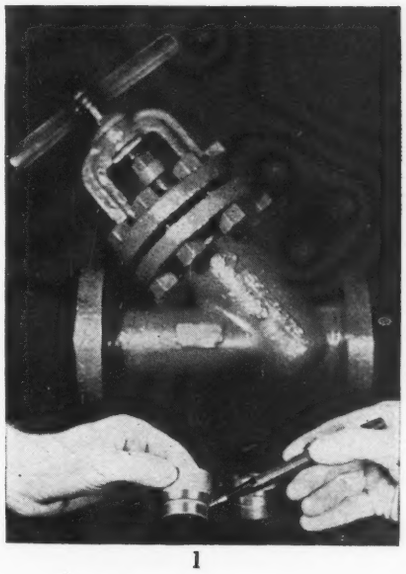
DC AIR CIRCUIT BREAKER—Main contacts have semi-flexible stationary portions while moving contact is solid. Mechanism is mechanically trip free from cooling solenoid or operating handle so that breaker will open immediately if an attempt is made to close it against extreme overload or short circuit. Single-pole breakers made in either pedestal or panel-mounted types in current ratings 2000 to 10,000 amp up to 750 volts dc. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*

MOTOR-STARTING AND BRAKING CONTROL—Three-breaker combination contains forward, reverse and braking oil circuit breakers. Each breaker is electrically operated with an independent solenoid mechanism. All three breakers are both electrically and mechanically interlocked, so that neither forward nor reverse breaker can be closed unless brake contacts are open. Breakers are 25,000-kva rupturing capacity, 7500 volts, 600 amps. *Westinghouse Electric & Mfg Co, E Pittsburgh, Pa.*

FLUORESCENT LAMP—Line of fluorescent "Lumiline" lamps gives 3 to 10 times light for equivalent power input to standard Mazda lamps. These new lamps comprise an evacuated glass tube 18, 24 or 36 in. long, with a cathode in each end, between which an arc is maintained. Mercury vapor sustains arc. Made in 15-, 20- and 30-watt sizes. Lamps giving green light produce 60 to 70 lumens per watt white and daylight lamps 30 to 35 lumens per watt, compared to approximately 10 per watt, white and daylight lamps 30 to 35 lumens *Co, Schenectady, N.Y.*

PIPING, FITTINGS AND VALVES

1 BLOWOFF VALVE—"Blo-Deflector" protecting lip a feature of this valve. Manufacturer claims that this design principle deflects boiler blow so effectively that valves are practically indestructible. Has steel valve disks hardened to 500 Brinell and renewable Stellite valve-seat rings. Made in both straightway and angle types for pressures up to 1660 lb. *Hancock Valve Div, Bridgeport, Conn.*



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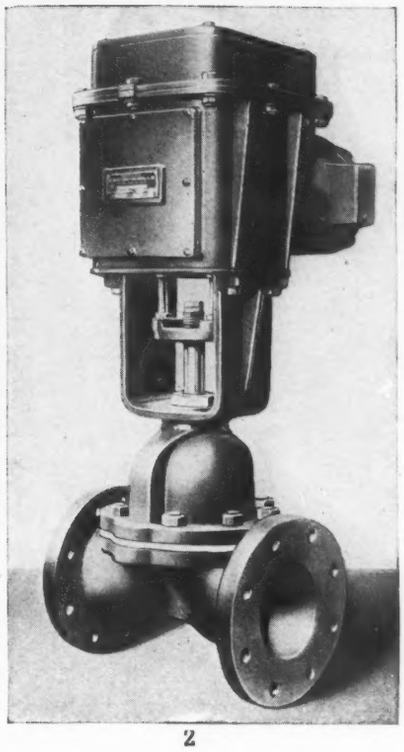
2 MOTOR-VALVE MECHANISM — Model C unit operates slip-stem valves for higher pressures and larger sizes. Illustration shows mechanism mounted on 4-in., 150-lb valve, and it exerts an opening and closing force on valve stem of 2000 lb with 5-in.-per-min movement and 2½-in. stroke. Strokes up to 10 in. and speeds of 3 to 10 in. per min are available, with corresponding changes in power. *Automatic Temperature Control Co, Inc, 34 East Logan St, Philadelphia, Pa.*



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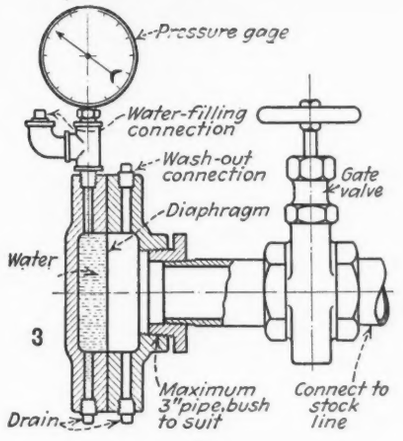
3 DIAPHRAGM-GAGE CONNECTION — For handling paper stock or other liquids containing fibrous materials, this gage connection consists of two recessed circular flanges with thin flexible diaphragm between them. One flange is tapped for 3-in. pipe connection, and can be attached through nipples and gate valve to stockline or other pipe. When gate valve is opened, pressure of stock or other fibrous material acts on one side of diaphragm, which transmits pressure to water on other side. *Goulds Pumps Inc, Seneca Falls, N. Y.*



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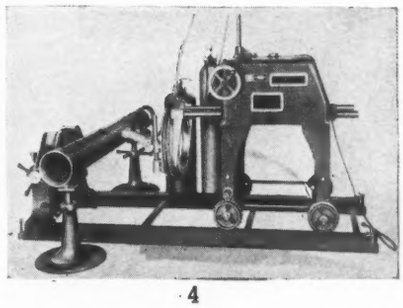
4 PIPE MACHINE — No. 512-A "Tom Thumb" portable pipe machine has diehead integral with carriage and threading dies rigidly supported. Front cutting diehead, together with close-grip front chuck, makes it possible to handle pieces as short as 2½ in. Internal oiling system for dies and cutting tool. Flexible hose carries oil from pump to diehead intake valve, and flow of oil is controlled by a 2-way thumb valve. *Oster Mfg Co, 2057 East 61st Pl, Cleveland, O.*



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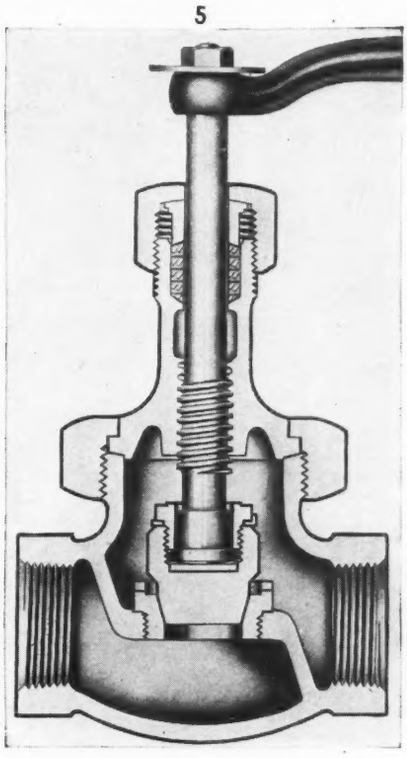
5 GLOBE AND CHECK VALVES—Line of brass screwed-end globe (in illustration) and check valves for 350-lb steam at 550 F may also be used for non-shock cold water, oil or gas lines up to 1000 lb. Globe valve with union bonnet (except 2-in. which has bolted bonnet) has nickel-alloy plug disk and Exelloy body seat ring. Horizontal-lift check valve has also union body except 2-in., which has bolted cap. Piston-guided disks and renewable seats. Horizontal-swing check valve has screwed cap and tapped hole to facilitate regrinding. Size range of ½ to 2 in. *Crane Co, 836 S Michigan Ave, Chicago, Ill.*



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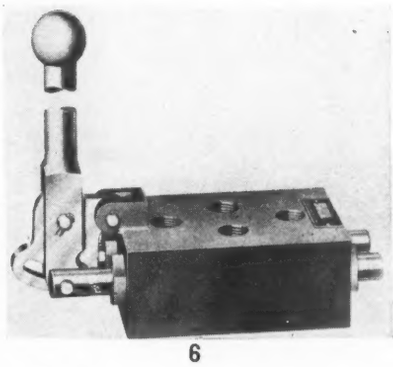
6 HYDRAULIC VALVE — Machined from solid steel slab for 1000- and 2000-lb working pressures. Made in 2-, 3- and 4-way types; latter two have only two internal parts for valving action to eliminate metal-to-metal wear. Piping connection can be made either above or below. Entire valving assembly and cylinder or leverage can be removed and replaced in a few minutes. Piping connection need not be disturbed for inspection. *C B Hunt & Sons, Salem, Ohio.*



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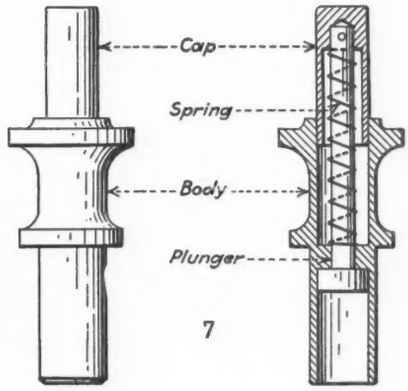
7 FITTING FOR EXPANSION JOINTS—"Yarway Pak-Aid" fitting facilitates insertion of new packing in Yarway "Gun-Pakt" expansion joints without removing packing-gun cylinders. Unit fits into cylinder of packing gun after gun plunger has been removed. By pushing down on plunger, new packing is forced into stuffing-box space. *Yarnall-Waring Co, Chestnut Hill, Philadelphia, Pa.*



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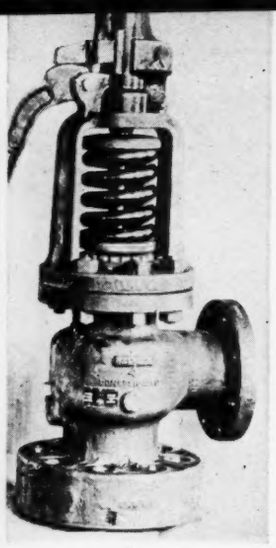

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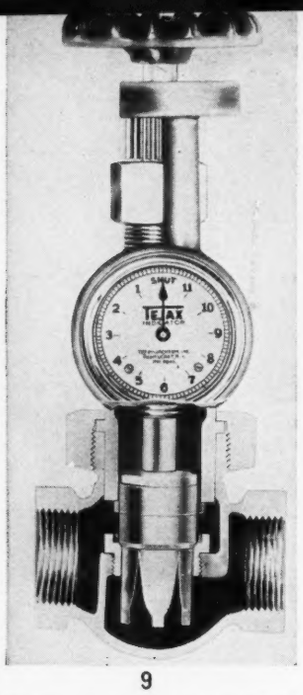

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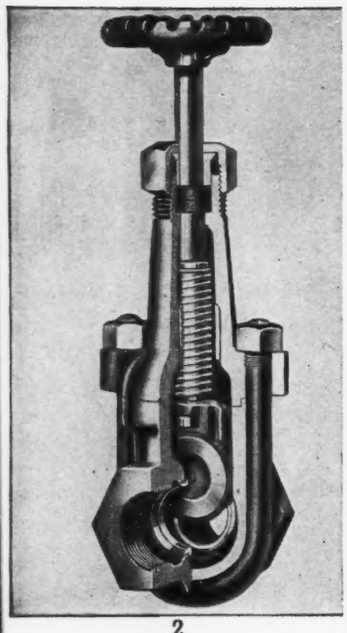

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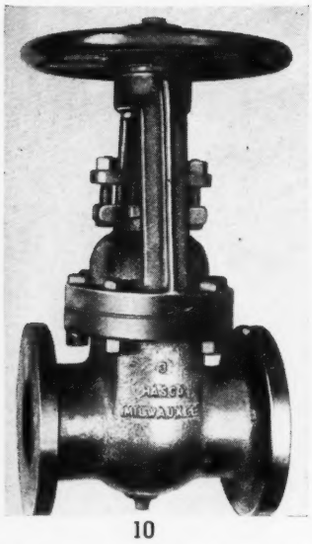

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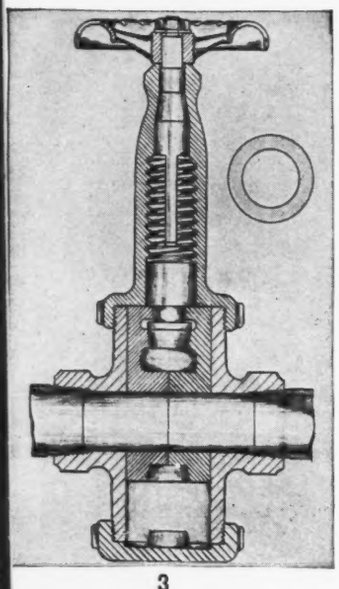

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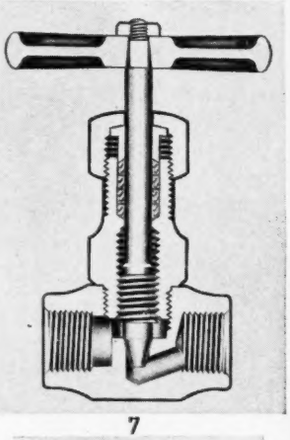

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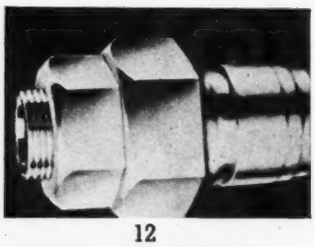

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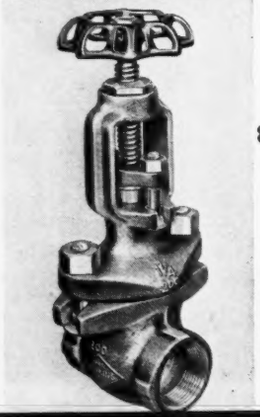

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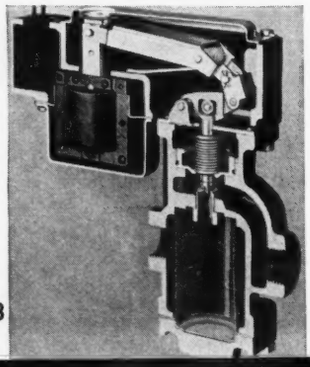

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1 STEAM TRAP—"Super-Silvertop" bucket steam trap has case and head of forged steel. Recess gasket joints prevent gasket blowouts. Heat-treated-alloy head bolts, valve and seat of "Anderloy", a special chrome alloy. All other parts are of stainless steel. Incorporates features of regular models, but is said to have 122% greater condensate capacity. *V D Anderson Co, 1935 W 96th St, Cleveland.*

2 GATE VALVE—U-bolt gate valve for 150-lb steam working pressure, 225-lb gas and liquid pressure, has body and bonnet of chrome-nickel alloy iron or semi-steel with average tensile strength of 40,000 lb per sq in. Relief slots in threaded bonnet bushing permit drainage back into body chamber, eliminating possibility of clogging above bonnet threads. *The Fairbanks Co, 397 Lafayette St, New York.*

3 GATE VALVE—Packless, "Stream-Flow" gate valve carries a cylindrical bore at right angles to line of flow. A cylindrical gate is moved up and down by a screw in valve bonnet, and is prevented from turning by a key in bore. Combines construction features of both plug and gate valves. Made in sizes ½ to 8 in. *Monat Valve & Forge Co, Bessemer Bldg, Pittsburgh.*

4 SELF-CLEANING STRAINER — Designed for straining gas or liquids at pressures up to 250 lb at 450 F. Where temperatures do not exceed 250 F, strainers can be used for pressures to 300 lb. Made of alloy cast iron with stainless strainer element. Made for pipe sizes from ¼ to 2 in. *V D Anderson Co, 1935 W 96th St, Cleveland, Ohio.*

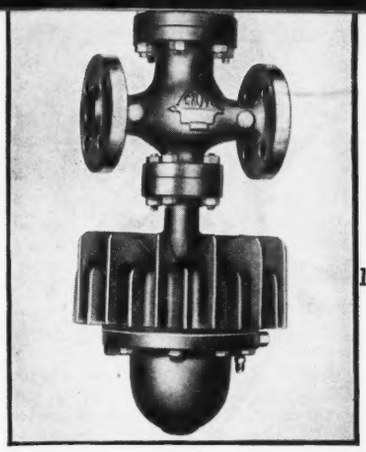
5 2500-LB SAFETY VALVE—Special alloy steels with low coefficients of expansion are used for bodies, bonnets, springs and trim. Bodies and bonnets are assembled with through bolts to prevent "freezing" at high temperatures. Trim is treated stainless steel. Constant seat diameter is insured by new bevel seat. Single-ring blowdown control. Designed for 2500 lb at 1000 F. *Consolidated Safety Valve Div, Bridgeport, Conn.*

6 U-BOLT VALVE—Bronze-mounted and all-iron U-bolt valve has "bonnet-saver bushing" which makes it unnecessary to junk valve bonnet when operating threads are worn. By slipping a new bonnet-saver bushing into position, good-as-new thread engagement is obtained in same bonnet. *Jenkins Bros, 80 White St, New York, N.Y.*

7 BARSTOCK VALVES — Small, 3000-lb water-or-gas plug type made as disk, globe and angle valves. For connections on orifice meters, regulator leads, bypasses, gages, ammonia expansion lines, etc. May be packed when wide open under pressure. Made in steel, Exelloy and 18-8 chrome-nickel alloy. *Crane Co, 836 S Michigan Ave, Chicago, Ill.*

8 CORROSION-RESISTANT VALVES — Stainless-steel, corrosion-resistant valves are made of Cooper 18-8 S and Cooper 18-8 SMO, each having a carbon content limited to a maximum of 0.10%. Both are highly resistant to corrosion, but Cooper 18-8 SMO is for most severe conditions. Made in 7 styles: solid wedge or double-disk gate valves, union-bonnet or bolted-bonnet regrinding globe or angle valves, and bolted-bonnet Y valves; all either screwed or flanged, in sizes ½ to 3 in. *Jenkins Bros, 80 White St, New York, N.Y.*

9 DIAL CONTROL VALVE—Bold-face valve-position indicator enables precise settings and easy duplication of desired results. High adjustment gives 30% more valve turns per unit of lift. Wire drawing is offset with renewable seatings and plug made from bronze, Monel, stainless steel or Nitralloy. *Tefft-Jackson, Inc, 2 Allens Ave, Providence, R.I.*



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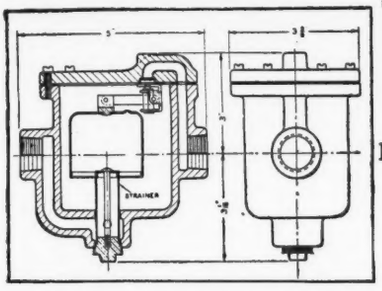

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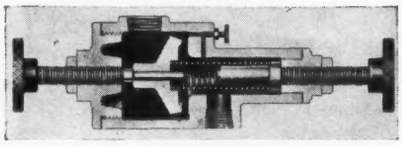

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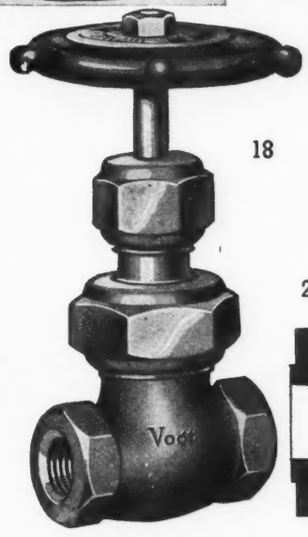

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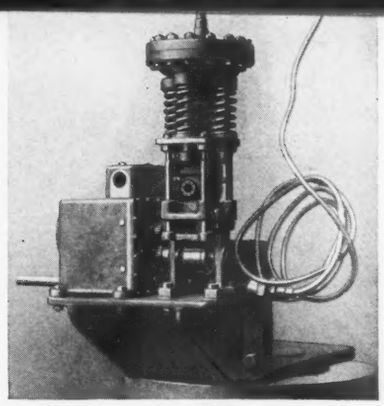

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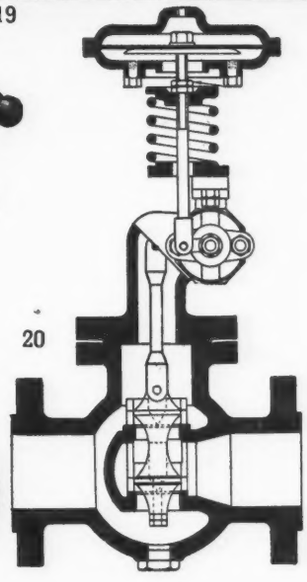

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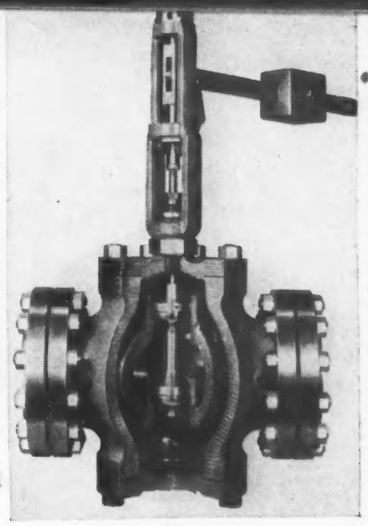

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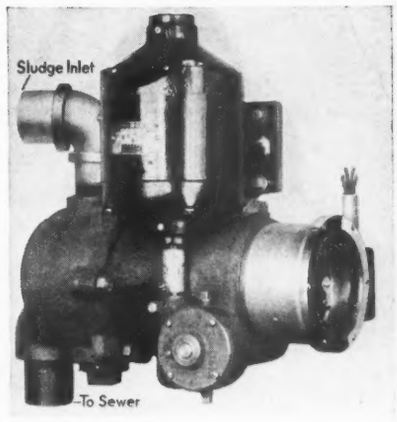


10 SEVERE-SERVICE VALVE—Gate valve for severe process conditions is made of 1½% nickel steel, with Meehanite disks faced with Monel rings and removable seat rings, and 3½% nickel-steel forged stem. Machined concave and convex contacting surfaces on inner sides of disks are large enough in diameter so that they are directly behind seating surfaces. This eliminates distortion of disks when valve is closed. *Hasco Valve & Machine Co, 1819 W St. Paul Ave, Milwaukee.*

11 MAGNETIC VALVE—Dual magnetic valve for hi-low fire or hi-low flow control has two electrically independent solenoids operating two lever-action, high-pressure valves. Will handle oils as heavy as No. 6 at usual room temperature or steam up to 125 lb pressure up to 400 F. Packless, normally closed; energy consumption is 14 watts per solenoid. *General Controls Co, 450 E Ohio St, Chicago.*

12 PIPE CONNECTION—"Multi-Seal" pipe connector permits attaching pipes without having to get on inside. Connector is inserted in hole, and then action nut is tightened. Can be used on steam, gas, oil, water and air lines and will withstand high pressures. Can be installed in 5 min by one operator. *Multi-Seal Mfg Co, 123 N Jefferson St, Chicago, Ill.*

13 SOLENOID VALVE—Weight of solenoid armature is not depended upon to hold valve closed; instead, it is tightly seated by spring-loaded leverage system. Long lever connected to solenoid armature gives solenoid mechanical advantage for positive opening of valve. Valve and seat are stainless steel. Will handle any fluid (not corrosive to its working parts) at any inlet pressure up to 150 lb. *McDonnell & Miller Co, Wrigley Bldg, Chicago, Ill.*

14 REDUCING VALVE—"Universal" reducing valve handles reduction up to 1500 lb SWP, 950 F. Air pressure is permanently sealed in a forged-steel dome, pressure depending upon what outlet pressure is desired. Upper side of diaphragm is impulsed by outlet pressure while lower side of diaphragm is subjected solely to loading force of air or gas pressure sealed within air dome. It is said that extremely smooth, pulsationless operation is due to controlling action derived from power chamber, which is connected to air dome by tiny orifice. Any quick force tending to make valve strike its seat is instantly counteracted by action of power chamber. *Grove Regulator Co, 1729 Poplar St, Oakland, Cal.*

15 PRESSURE REGULATOR—Type ED regulator built in sizes ⅜- to 12 in., for air, steam, water, oil and gas, for initial pressures to 600 lb and 750 F. Delivery-pressure line is connected to underside of pilot diaphragm by control pipe. When pressure drops in control pipe, main spring forces pilot valve open. This allows initial pressure to flow past pilot faster than it can escape through bleed port, causing increase in pressure on underside of main-valve diaphragm, which in turn forces main valve open. *Spence Engineering Co, Inc, Walden, N.Y.*

16 INVERTED-BUCKET TRAP — Straightway trap made in one size with ⅜- or ½-in. inlet and outlet connections. Connections are arranged on opposite sides of body on same center line to provide straight-through flow. Working mechanism is attached to trap cover so that it can be removed without disturbing piping connections. Sarco strainer is built into trap, eliminating separate strainer. *Sarco Co, Inc, 183 Madison Ave, New York.*

17 SHUTOFF VALVE—Automatic shutoff valve is placed in supply line above flexible hose used to convey compressed air, steam, gas or fluids under pressure. As long as pressure at inlet and outlet are nearly equal, or the same, plunger is maintained in open position by a spring, permitting air, steam, etc, to flow around in a normal manner. Plunger can be adjusted to shut off automatically flow at any desired pressure at inlet. *D J Murray Mfg Co, Wausau, Wis.*

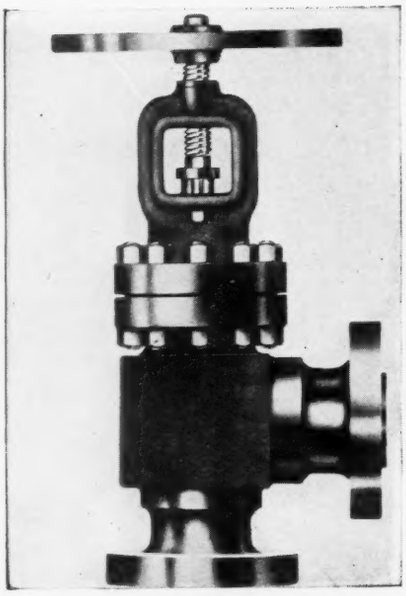
18 FORGED-STEEL VALVES—Line of drop-forged, union-bonnet valves is made in ¼-, ⅜- and ½-in. sizes. Hexagon body ends, ground joint between body and bonnet. Recommended for 900 lb working pressure at 75 F or 1500 lb non-shock cold-working pressure. *Henry Vogt Machine Co, 10th & Ormsby Sts, Louisville, Ky.*

19 THERMOSTATIC PILOT — Type ET vapor-tension temperature regulator will operate on any pressure above 5 lb. It can be operated by steam, compressed air, water, etc. Made in sizes from ¼ to 12 in. Normal range of 100 F of temperature adjustment, obtained by screwing up or down on adjusting nuts. *Spence Engrg Co, Inc, Walden, N.Y.*

20 REDUCING VALVES—Line of Copes reducing valves, built in a variety of size ranges and styles, has a reinforced rubber diaphragm as actuating element. One side of diaphragm is open to atmosphere; other side is subjected to controlled pressure. This is counterbalanced by a spring to maintain reduced pressure within specified limits. Any change in controlled pressure causes diaphragm to move. *Northern Equipment Co, Erie, Pa.*

21 BALANCED-LEVER VALVE—Series 42 balanced-lever valve is for steam, air, water and most gases. In Type 42-R illustrated, roller-guided top insures free valve movement, valve-stem alignment, etc. Double or single seat. Any type inner valve: parabolic, flat with bevel seat, V-port with bevel seat, and V-port, non seating. ½- to 3-in. sizes, screwed ends; 1 to 12 in., flanged ends. *A W Cash Co, Decatur, Ill.*

22 DESLUDGING VALVE—Developed as a part for its hot-process lime-soda water softener, manufacturer has put on market an automatic motor-operated valve for permitting flow of sludge from a container by gravity or under pressure. Valve has been made automatic because periodic operation by hand is apt to be overlooked or postponed. *The Permutit Co, 330 West 42nd St, New York, N.Y.*



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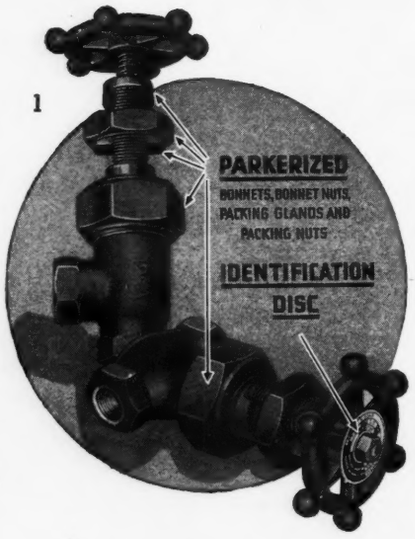

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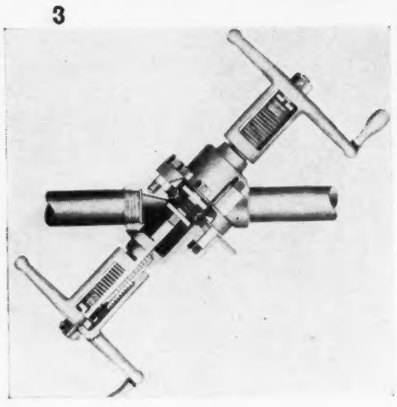
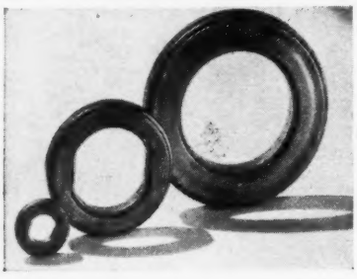




4

1 FORGED-STEEL VALVES — Drop-forged steel valves now made with Parkerized bonnets, bonnet nuts, packing glands and packing nuts. Rust-proofing process eliminates galling of threads due to atmospheric corrosion. Added improvement is identification disk held in place by hand-wheel nut. This disk records valve size, number, working pressure and temperature, and style of trim. *Henry Vogt Machine Co, 10th & Ormsby Sts, Louisville, Ky.*

2 FORGED-STEEL STOP VALVE — Made from single block of forged steel in sizes from 2½ to 8 in. for pressures to 2500 lb, with flanged ends or with ends prepared for any type of welding. Bodies, flanges and bonnets are all hammer forged from chrome-moly steel, all seats are Stellite faced and trim is stainless steel. Made in both angle and offset types; latter has pressure drop approaching that of a gate valve. *Clees Valve & Engrg Co, 90 West St, New York, N.Y.*

3 BLOWOFF VALVE—Combines high-pressure flanged union with a double valve. Usual valve body is eliminated. Two bonnets securely hold single stainless-steel seat ring in place and tightness is assured by lapping seat ring to face of bonnet flange. Flanges are set 45 deg to axis of flow. Each half is removable with its corresponding pipe section, making both valves completely accessible. Made in 4 stock styles for pressures up to 600 lb. *Clyde Div, R W Cramer & Co, Inc, 67 Irving Pl, New York, N.Y.*

4 VALVE DISK—All-purpose laminated valve disk is built up of alternating layers of asbestos and metal encased in a 2-piece shell of copper, Monel or other alloy. Shell protects laminated parts of disk and affords flat seating surface. Made for globe valves that require renewable disks in sizes ¼ to 12 in., with round or oblong valves. *Goetze Gasket & Packing Co, Inc, New Brunswick, N.J.*

BUTTWELD PIPE—Type C-P buttweld pipe is made in continuous-process mill under Fretz-Moon patents heretofore used in England, Germany and Australia. Manufacturer claims cleaner welds, smoother and cleaner inside finish, more durable pipe and uniform 20-ft lengths, resulting from closely controlled heat and welding operation. Sizes ½ to 3 in. ID. *Spang Chalfant, Inc, Grant Bldg, Pittsburgh.*

PLUG-DISK VALVES—Brass globe and angle valves have disks of nickel alloy and body seat rings of heat-treated chromium iron. For 150-lb steam and 300-lb cold water, oil or gas. Stuffing boxes are fitted with a gland, which may be repacked under pressure when wide open. Size range of ⅛ to 3 in. Also recently developed are iron-body valves, made in sizes ¼ to 3 in., with same characteristics. *Crane Co, 836 S Michigan Ave, Chicago, Ill.*

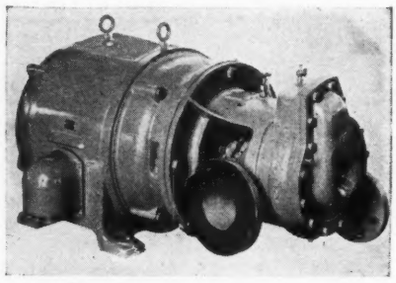
PUMPS

1 MOTOR-PUMP UNIT—Two-stage Type MKE motor pump in one compact unit. Rotor of motor and pump impellers are assembled on a common shaft carried on two ball bearings within motor. Pump case is 2-stage volute type made of Meehanite cast iron. First and second stage impellers are corrosion- and acid-resistant phosphor bronze. Made for capacities of 150 to 300 gpm and for heads of 250 to 300 ft. *Victor Equipment Co, Kimball-Krogh Pump Div, Los Angeles, Calif.*

2 CENTRIFUGAL PUMP—"Moyno" pump designed to combine self priming and high pressures of piston pump with uniform flow and valveless operation of centrifugal pump. Working elements are a stator, in which is molded an internal helix, and a spiraled and eccentric rotor, which rolls on stator with hypocycloidal motion. Interaction of these two elements as rotor is revolved squeezes pump liquid ahead. Valves are unnecessary, as contact between rotor and stator seals pump against forward or backward flow of liquid. *Robbins & Myers, Inc, Springfield, O.*

3 HYDRAULIC PRESSURE PUMP—"Uni-flo" pump for operating hydraulic machinery is combination of "squashplate" operating mechanism with conventional packed plunger and poppet valves. Power unit is separate from hydraulic end and is fully enclosed. Hydraulic end is a single-piece steel forging drilled for plungers and valves. Arrangement of passages and valves permits use of plungers disposed in a circular fashion with transverse suction and discharge passage extending through block. Made in sizes from 2 to 100 hp for pressures of 1500 lb per sq in. and up. *Watson-Stillman Co, Roselle, N.J.*

4 CENTRIFUGAL PUMP—Type HDB, single-stage, side-suction, vortex centrifugal pump is being built in sizes of 1½- to 18-in. discharge, 10- to 15,000-gpm capacity, and heads up to 300 ft in smaller sizes. Pump casing of solid volute type with removable suction head. Eccentric nozzle on suction head permits removal without disturbing discharge pipe or pump alignment. Two heavy-duty, double-row ball bearings, lubricated by an oil reservoir, support shaft. Bearing nearest pump carries radial load and is self-aligning. *Lawrence Pump & Engine Co, PO Box 70, Lawrence, Mass.*



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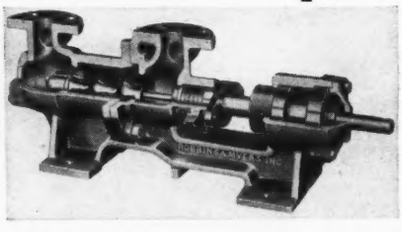

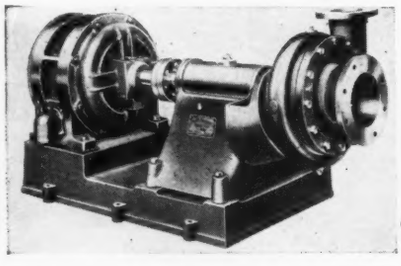

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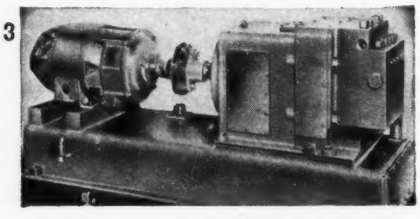

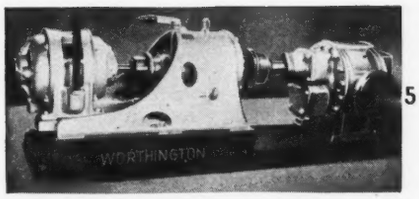

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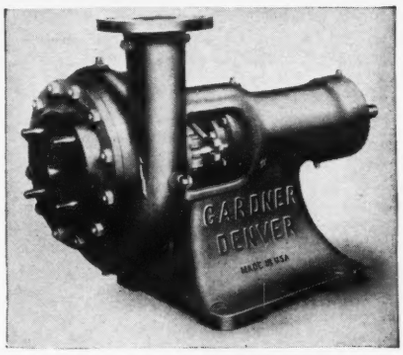

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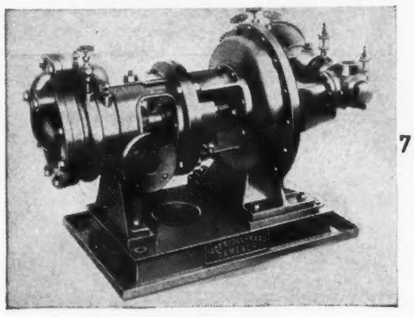

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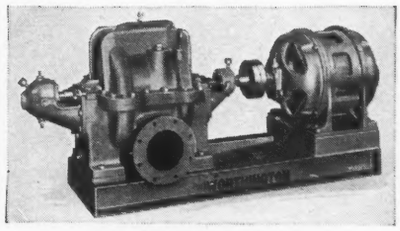

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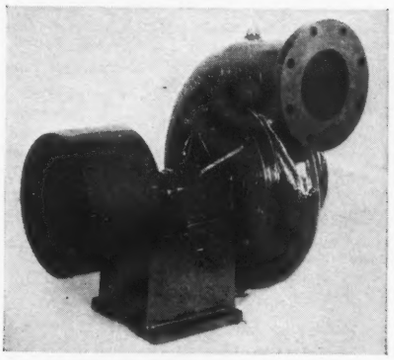

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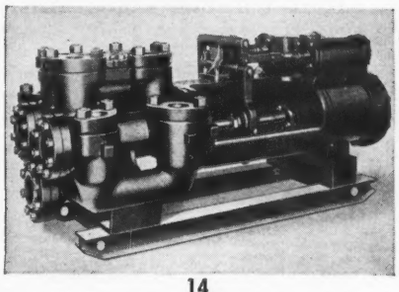

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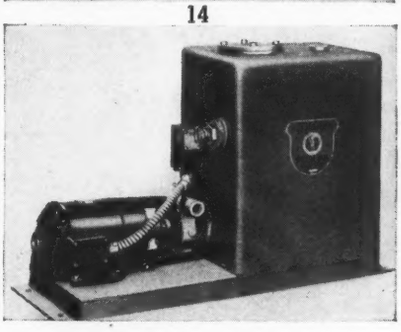

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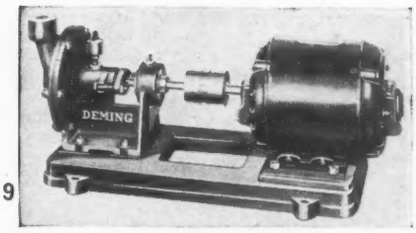

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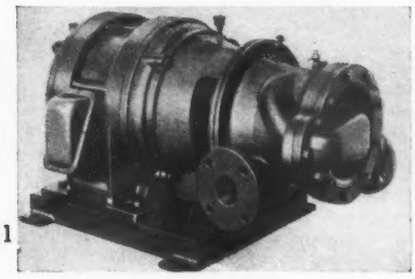

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5 PUMPING UNIT—Compact pumping unit for bulk-transfer service where both thin and highly viscous liquids are handled. Herringbone-gear-impeller pump driven by constant-speed motor or internal-combustion engine through 2-speed enclosed transmission. For light liquids, pump can be operated at high speeds; for viscous liquids, pump speed can be reduced. In conventional applications of single pumping units, motors are selected for heaviest loads and are operated at a fraction of their rated power when pumping thinner liquids. *Worthington Pump & Machinery Corp, Harrison, N.J.*

6 CENTRIFUGAL PUMPS — Non-clogging Types J and K centrifugal pumps designed for handling industrial wastes, process fluids, etc. Impeller, of hard close-grained alloyed cast iron with two streamlined blades, is rounded to prevent catching stringy or fibrous material. High-tensile-strength alloyed-cast-iron casing; separate casting stuffing box bolted directly to casing. Built for both horizontal and vertical drypit installations. *Gardner-Denver Co, Quincy, Ill.*

7 TURBINE-DRIVEN PUMP—Combines turbine and pump as one unit on common shaft. Built in single-stage sizes for capacities from 5 to 1000 gpm against heads as high as 200 ft, and in 2-stage sizes for capacities to 275 gpm and heads to 550 ft. For general industrial service as well as for boiler-feed service at pressures up to 200 lb. Can be operated on compressed air. *Ingersoll-Rand Co, 11 Broadway, New York, N. Y.*

8 CONDENSATE PUMP—Two-stage centrifugal hotwell and condensate pump has oversize suction opening, pickup-type impellers, large vents. Cast-iron casing is horizontally split for ready access and removal of rotor. Single-suction enclosed bronze impellers are mounted on shaft with suction openings facing inward. Back, or discharge, sides of impellers are thus adjacent to stuffing boxes, so that latter are under first and second-stage discharge pressures respectively, preventing air leakage. *Worthington Pump & Machinery Corp, Harrison, N.J.*

9 CENTRIFUGAL PUMP—Side-suction, single ball-bearing centrifugal pumps made in two sizes: with ½-in. discharge and ¾-in. suction, and with ¾-in. discharge and 1-in. suction. Pumps direct connected to motors suitable to speeds up to 3500 rpm; belt-driven pumps to 3000 rpm. Non-overloading bronze impeller, stainless-steel shaft, bronze gland and oversize deep-groove ball bearing. Either size pump can be had with direct-connected gasoline engine. *The Deming Co, Salem, Ohio.*

10 CENTRIFUGAL PUMPS — Line of single-stage ball-bearing centrifugal pumps, Fig. 3610 (belt drive) and Fig. 3612 (motor drive) built in 18 sizes to give capacity range of 5 to 1600 gpm against heads up to 110 ft. Cast-iron casing, with suction and discharge openings cast integral. Heavy-duty ball bearing in outboard end of support head takes radial and all thrust load. *Goulds Pumps, Inc, Seneca Falls, N. Y.*

11 CENTRIFUGAL PUMP—Supplementing line of single-stage "SSUnit" pumps, this 2½x1½-in., 2-stage pump is good for heads up to 525 ft at 3350 rpm. It has capacity range of from 50 to 100 gpm against heads of 300 to 500 ft. Is bolted to motor frame by splash-proof connection piece, impellers being mounted on special motor-shaft extension. Pump is made with standard squirrel-cage motors of from 10 to 30 hp, splash- or explosion-proof. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

12 DUPLEX STEAM PUMP—For oil, water and other free-flowing liquids at high temperatures. 8-cover, side-pot fluid end permits easy servicing. Each suction and discharge valve is in its own valve pot and is easily accessible through single valve-pot cover. Steam and fluid ends are sealed by packing in deep stuffing box fitted with removable bolted gland. Capacities up to 148 gpm and fluid-end pressures up to 1000 lb per sq in. *Fairbanks, Morse & Co, 900 S Wabash, Chicago, Ill.*

13 CLOSE-COUPLED PUMP—Type H close-coupled centrifugal motor pump, for capacities up to 250 gpm and heads up to 250 ft at speeds of 1750 and 3460 rpm, can be installed in any position. Is single suction, with single-stage enclosed bronze impeller. Adjustable bearing in outboard end of motor compensates for wear between pump clearance spaces. For portable and semi-portable operation as well as stationary. *Gardner-Denver Co, Quincy, Ill.*

14 CONDENSATION PUMP—Close-coupled "Hot Shot" condensation pump has Yeomans "Moto-pump" operating unit with balanced bronze impeller mounted on rust-proof steel motor shaft. Receiver is welded copper-bearing steel. Float switch, with cadmium-plated brass float and working parts, operates through a stuffing box 4 in. wide. Switch is mounted on a screw-in connection through which whole mechanism can be removed. Range of capacities of 1½ to 25 gpm. *Yeomans Bros Co, 1433 Dayton St, Chicago, Ill.*

1 ROTARY PUMP—Variable-speed, variable-capacity rotary pump unit in both standard and sanitary models, latter for food plants. Turning a small handwheel near base plate raises or lowers motor base plate, increasing or decreasing pitch of V-belt motor pulley. This in turn changes motor speed and pump capacity. 1800-rpm motor—speed ranges of 200 to 500 rpm are possible. *Viking Pump Co, Cedar Falls, Iowa.*

2 PUMP BYPASS CONTROL—Smoot automatic pump bypass control has been developed to prevent overheating of large high-pressure centrifugal pumps operating under low-load conditions. When flow through a pump reaches a measured predetermined low flow, pump control opens a bypass valve, permitting measured amount of water to flow from pump discharge to convenient point in feedwater circuit, from which it will flow back to feed-pump suction. Pump bypass remains open until flow through pump increases to a second predetermined rate of flow, at which point bypass closes. *Republic Flow Meters Co, 2240 Diversey Parkway, Chicago, Ill.*

3 CENTRIFUGAL PUMPS—Line of close-coupled steam-turbine centrifugal pumps, of "SSUnit" type, are made in single- and two-stage units for capacities up to 500 ft head. Cast-iron casings and bronze fittings. Suitable for industrial plants where process steam is available; in some cases, compressed air can be used to drive turbine. *Allis-Chalmers Mfg Co, Norwood Works, Cincinnati, Ohio.*

4 DEEPWELL PUMP—UTA pumping unit consists of vertical centrifugal pump direct connected to submersible vertical motor, suspended on riser pipe to operate below water in well. Water-proof cable conducts current to motor, which can be furnished for either 60 or 50 cycles ac, single or 3 phase. Rotor operates in water, but stator is protected from water by patented, rustproof, stainless-steel cylinder. For industrial and air-conditioning purposes. *American-Marsh Pumps, Inc, Battle Creek, Mich.*

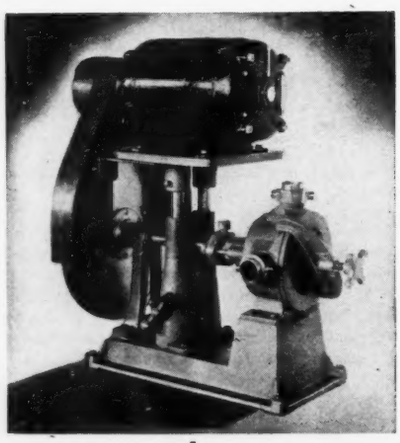
5 CENTRIFUGAL PUMP—Fig. 3390, 2-stage centrifugal pump with hydraulically balanced opposed impellers, is built for heads up to 1000 ft and in three sizes for capacities to 600 gpm. Horizontally split, cast-iron casing; acid-resisting bronze impellers; deep-groove ball bearings. *Goulds Pumps, Inc, Seneca Falls, N.Y.*

6 CENTRIFUGAL PUMP—Type CRV, end-suction centrifugal pump is built in capacities to 1000 gpm for heads to 500 ft. Either single- or 2-stage construction, open or closed impeller, and a variety of drives including motor, steam turbine, gasoline engine or belt. Open impeller in conjunction with hand-hole suction piece useful for plants where heavy liquids are handled. *Ingersoll-Rand Co, 11 Broadway, New York, N.Y.*

7 BOILER-FEED PUMP—High-pressure, single-stage centrifugal feed pump, for pressures up to 500 lb per sq in. and deliveries to 350 gpm, is powered by 2-velocity-stage steam turbine rated for 500 lb and 700 F total temperature. Control is by overspeed trip governor, a spring-loaded assembly requiring no adjustment. Governor normally does not make any mechanical contact with trip lever connected to emergency valve; only at overspeed does governor engage trip lever. Pump operates at 7150 rpm, and because of high speed, pump and turbine form compact unit. *J S Coffin, Jr, Co, Englewood, N.J.*

8 SUBMERSIBLE PUMP—Deepwell turbine pump has motor below turbine bowels. Short propelling shaft and long, small-diameter motor. Turbine and submersible motor form compact unit that is attached to and supported by discharge pipe. Submarine armored cable and small copper oil tube, form only connection (aside from discharge pipe) between pumping unit and ground surface. Water is sealed out at top by mercury in a rotating cup attached to motor shaft. *Byron Jackson Co, Dept 120, Los Angeles, Calif.*

9 COOLANT TANK AND PUMP UNITS—Series of self-contained coolant tanks and pump units made in 5 sizes. Models 8H and 15H have Pioneer Model H pump mounted in compartment below tank bottom and cast-iron covers with built-in strainers. Models 26V, 35V and 50V have Model V pump mounted on stationary part of tank cover and pump is immersed in coolant. Capacities to 80 gpm and



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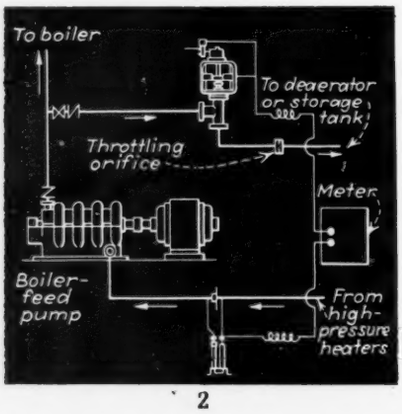

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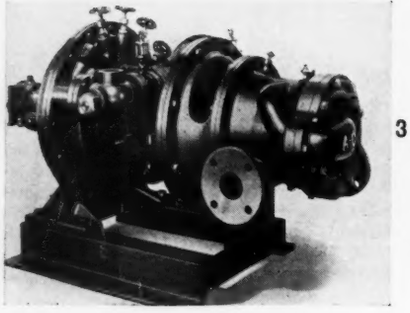

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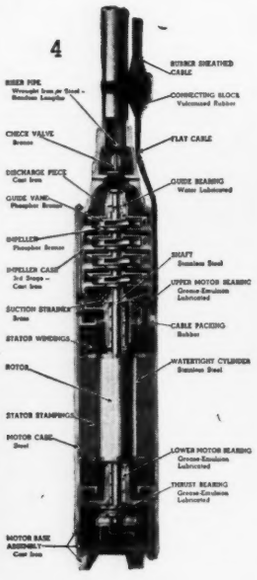

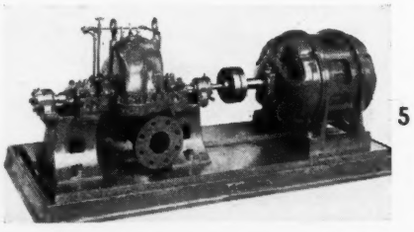

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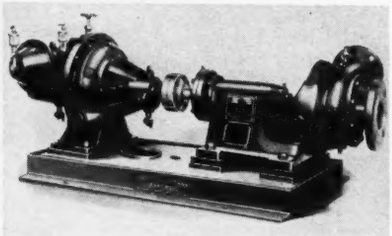

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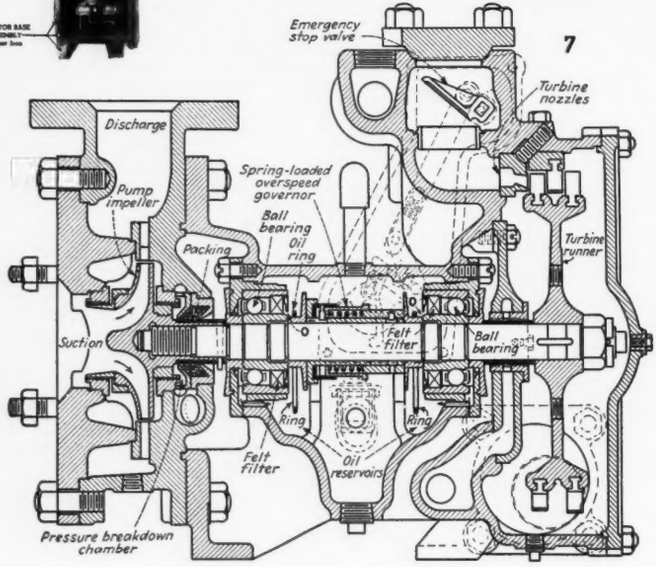

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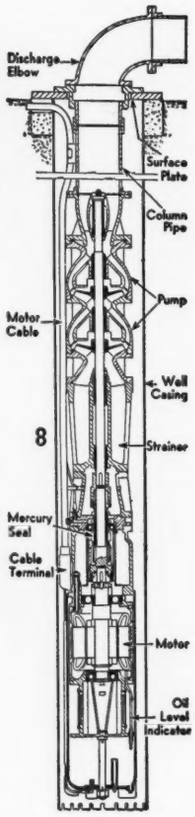

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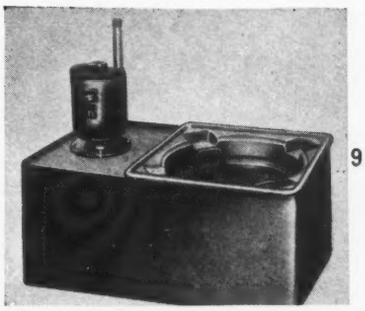
pressures to 53 ft of head. *Pioneer Engineering & Mfg Co, 31 Melbourne Ave, Detroit, Mich.*

10 ELBOW - PROPELLER CIRCULATING PUMPS—For handling water, semi-viscous liquids, etc, these elbow-propeller circulating pumps can be installed in pipelines for booster service, small number of vanes and large openings providing large streamline flow channel. Capacity range from 1000 to 2000 gpm, at heads up to 20 ft. *Worthington Pump & Machinery Co, Harrison, N.J.*

11 SELF-PRIMING PUMP—"Auto Pump" combines in compact unit, pump and priming tank adaptable to full automatic control. Only part of air handled during priming period passes through pump; greater part is expelled from priming tank directly into discharge line. Once primed, pump will hold its prime for days. Made in six sizes from 1 to 15 hp, 1800 and 3600 rpm. *Barrett, Haentjens & Co, Hazleton, Pa.*

12 PUMP-VALVE SERVICE — Open-type guard allows unrestricted flow, eliminates possibility of spring clogging, protects spring and correctly limits valve lift. Stud is kept from wearing by a sleeve that also provides support for guard, which is removable for inspection of valve parts. This valve service can be used on any type of reciprocating pump. *Durabla Mfg Co, 114 Liberty St, New York.*



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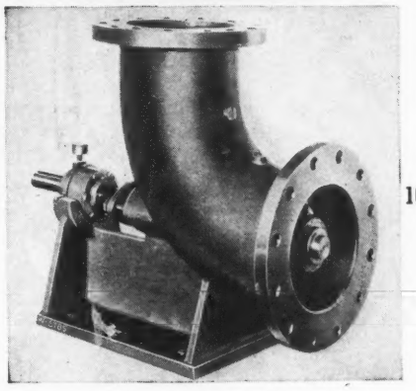

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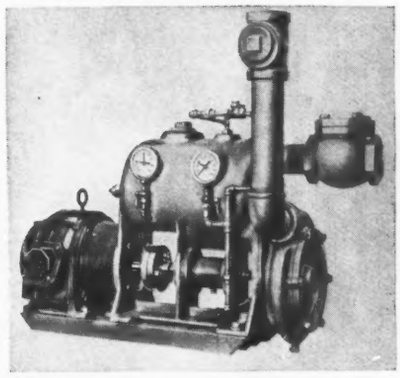

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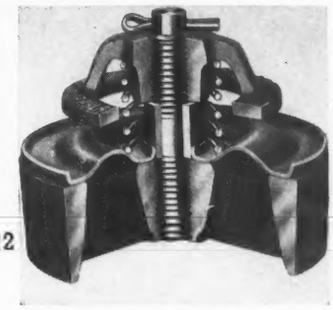

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WELDING

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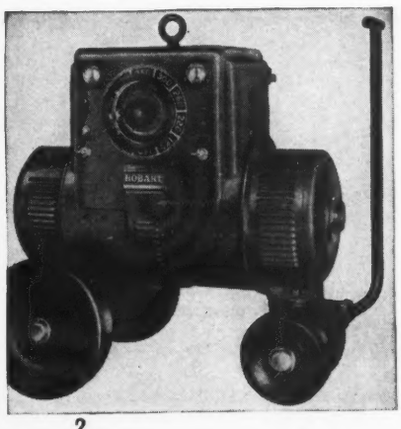

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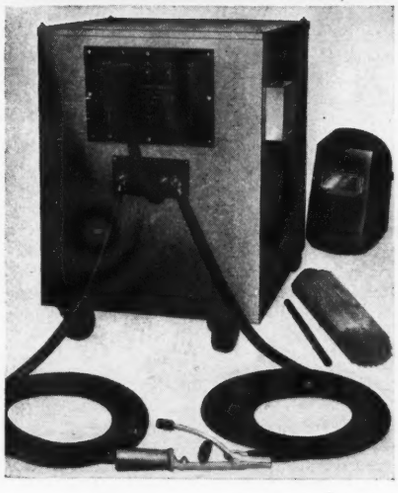

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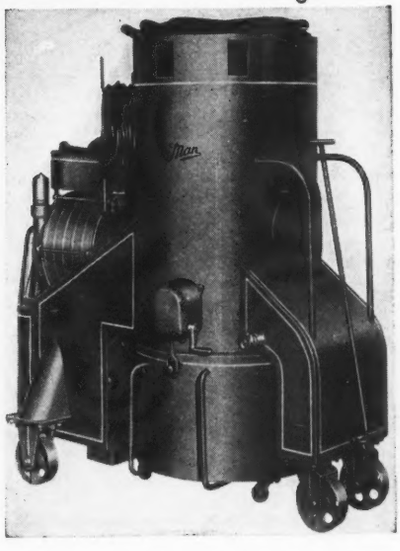

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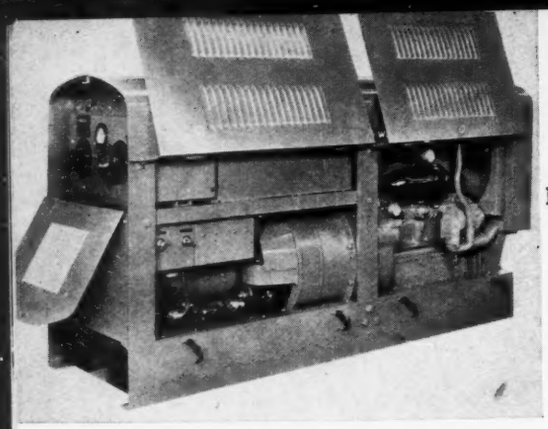
1 150-AMP WELDER—Designed to occupy minimum of floor space, new welder is for lighter gage metals, both ferrous and non-ferrous. Furnished in ac drive only, machine is less than 4 ft in over-all height. Towing handle provides easy movement around shop. Cooling and ventilating through fresh-air intake at top, and exhaust at bottom. Plug-in cable receptacles for easy current reversing, and patented single-current control device. *Harnischfeger Corp, 4400 West National Ave, Milwaukee, Wis.*

2 ARC WELDERS—Line of multi-range arc welders has welding range divided into 10 ranges with a 100-step, continuously wound rheostat operating in each range. Welding ranges are selected by turning a large handwheel on front of "Turret Top" control cabinet. Separate voltmeter and ammeter are also provided (optional with Junior models), flush mounted on front panel. Junior models have built-in electric motors in 100- and 150-amp ratings or self-starting gasoline engines in 200-amp rating. Senior models include 150-, 200-, 300-, 400- and 600-amp electric drive; 200-, 300-, 400- and 600-amp gasoline-engine drive; and 200-, 300- and 400-amp generators for connection to customers gasoline engine or electric motor. *Hobart Bros, Hobart Square, Troy, Ohio.*

3 ARC WELDER—200-amp gasoline-engine-driven arc welder is mounted on steel skids and has complete canopy enclosure with hinged side panels that fold up over and can be padlocked when closed. Accessory equipment includes electric self-starter, battery ignition with generator, built-in fuel pump, air filter, variable-speed governor, radiator, and built-in gasoline fuel tank. *Hobart Bros, Hobart Square, Troy, Ohio.*

4 ARC WELDER—Model 250 ac welder has plug-in control panel. Output range from 25 to 250 amp in 10 steps. Cast-steel case and ball-bearing swivel casters. Operates on 220- or 440-volt, 50- or 60-cycle current. Forced-draft cooling system and enclosed power terminals. Will take welding rods up to ¼ in. *Commonwealth Mfg Corp, 4208 Davis Lane, Cincinnati, Ohio.*



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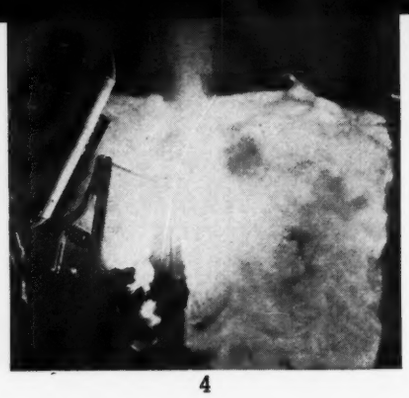

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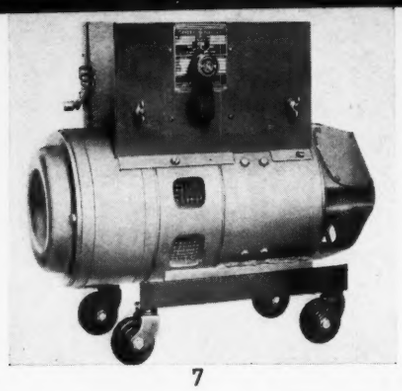

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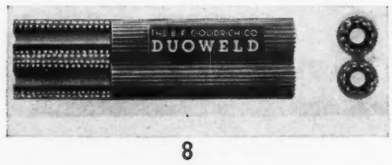

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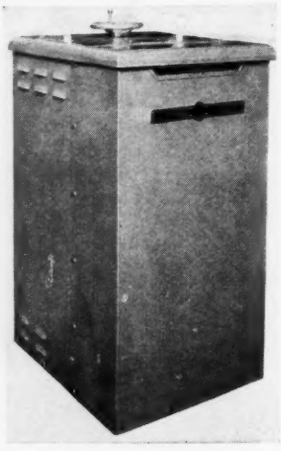

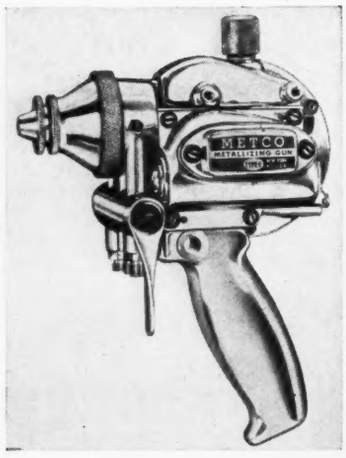

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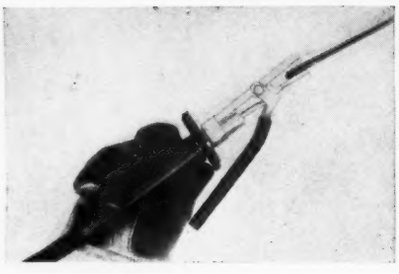

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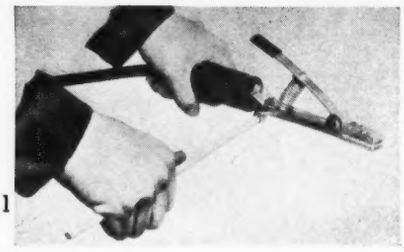

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1 ARC WELDER—Diesel-driven welder has patented engine-combustion chamber that accelerates turbulence of fuel and air mixture. Pintle-type fuel nozzles; five filters (3 fuel-oil filters, 1 oil-type air filter and 1 lube-oil filter). Main welding generator is a 300-amp "Shield-Arc SAE" unit with dual continuous control, has continuous voltage control, laminated magnetic circuit, and high capacity. *Lincoln Electric Co, Cleveland, Ohio.*

2 AC ARC WELDER—150-amp ac arc welder for low-current welding with heavily coated welding electrodes, is chiefly intended for light-gage metals. Built with woven, spun-glass fireproof insulation which prevents damage from heat on heavy overloads. Solidly brazed internal connections eliminate possibility of open circuits. Continuous, stepless current control is obtained by a hand crank. Choice of two open-circuit voltages (80 and 100 volts) is provided to handle all types of ac electrodes. *General Electric Co, Schenectady, N.Y.*

3 ATOMIC - HYDROGEN WELDER — Arc-welding equipment is intended for welding special alloys and thin sections. Ac arc is maintained between two adjustable tungsten electrodes, and at same time hydrogen gas is fed to arc and around electrodes. Hydrogen molecules, subjected to intense heat of arc, are broken up into atoms. Majority of these atoms, recombining outside arc zone, liberate extremely high heat. Remaining atomic hydrogen provides an active reducing atmosphere that prevents oxidation of weld metal, reduces surface oxidation of parent metal, and protects and cools electrodes. *General Electric Co, Schenectady.*

4 ELECTRIC PIPE PREHEATER—Flexible electric preheater for alloy pipes consists of indicating pyrometer, 2-heat switch and an arrangement of adjustable heating elements in a connecting linkage that holds heating elements in direct contact with pipe. A temperature of 600 F is reached in less than ¾ hr on 6-in. carbon-moly pipe. Heaters are arranged for heating a distance of approximately 4 in. on either side of weld. For a single phase, 220-volt current. *Detroit Electric Furnace Co, 825 W Elizabeth St, Detroit, Mich.*

5 WELDING HOSE—Will resist action of molten metal or accidental exposure to torch flame long enough to permit operator to reach place of safety. Combines fire-resisting compounds with fabric and asbestos insulation, non-kinking carcass will not flatten permanently, and tube will not flake off and clog welding head. *Goodyear Tire & Rubber Co, Inc, Akron, Ohio.*

6 METAL-SPRAY GUN—Type E "Metco Metallizing Gun" has improved nozzle and jet construction that reduce gas consumption and result in deposit of maximum amount of metal sprayed. A multiple jet turbine makes available two speed ranges, which cover all speeds necessary for commercial metals. Recommended pressure of 15 lb. *Metallizing Engineering Co, Inc, 44 Whitehall St, New York.*

7 DC ARC WELDER—150-amp single-operator arc-welding equipment has high, instantaneous voltage recovery that prevents arc pop-outs. Any welding current within range can be quickly obtained by a 3-point selector switch. Isothermic overload protection permits carrying maximum safe overload without danger of burnouts and without unnecessary interruptions on harmless overloads. *General Electric Co, Schenectady, N.Y.*

8 OXYACETELYNE HOSE — "Duoweld" consists of two strands of ¼-in., 2-braid hose with corrugated cover which are molded together. Cover on one strand is red, other is green. Color distinction aids in identifying acetylene from oxygen line. Made in 12½-, 25- and 50-ft lengths. *B F Goodrich Co, Akron, Ohio.*

9 WELDING AIR CLEANER—"Lincolnditioner", an air cleaner for welding, grinding, etc, consists of motor-driven fan which produces suction through flexible tube. Fan draws air through flexible tube and exhausts it into a filter in periphery of power unit. Flexible metal tube is supported by welded-steel arm, so that nozzle can be shifted to any desired spot. *Lincoln Electric Co, Cleveland, Ohio.*

10 ELECTRODE HOLDER—"Tweco" electrode holder, light weight and cool running, has insulated spring-tensioning member that is enclosed and out of the way. Spring tension is adjustable to suit strength of operator or size of electrode. Holder jaws have electrode lock from which rod cannot fall out of position. Handle grip, guard and trigger are shockproof. Replaceable copper-jaw tips. *Tweco Products Co, 111 West 3rd St, Wichita, Kan.*

11 ELECTRODE HOLDER—Lightweight arc-welding electrode holder weighs 14 oz and has current capacity of 250 amp continuous. All contacts electrically welded. Easily operated

clamp locks cable to electrode holder. Clamp can be tightened or loosened without tools by inserting electrode through square head of clamp cap screw and applying pressure. *Lincoln Electric Co, Cleveland, Ohio.*

WELDING ELECTRODE—"Smootharc Har Ten" electrode designed for welding Man-Ten, Cor-Ten, High-Steel, Republic Double Strength, Yoloy, etc. Made in two types: *A* for flat, vertical and over-head work; *B* for flat work only. Both are available in sizes ⅛ to ¼ in. in diameter, 14-in. lengths. *Harnischfeger Corp, 440 W National Ave, Milwaukee, Wis.*

WELDING COMPOUND — "Spatter Film" compound is said to lower cleaning time after welding by 20 to 60% by reducing tendency of spatter to adhere tightly, thus facilitating its removal. Is soluble in water, non-inflammable, contains no free alkali, and can be applied by paint brush. *Lincoln Electric Co, Cleveland.*

WELDING ELECTRODES—Three welding electrodes, Types W-20E, W-22E and W-23E, are intended for shielded-arc welding of mild steel. W-20E is for general-purpose, single or multiple-pass arc welding with ac or dc (straight polarity). W-22E is fast-melting, smooth-flowing electrode with low spatter loss. W-23E is a high-current or "hot" rod, so weld metal is quite fluid and washes up well on side walls of deep-groove joints and fillets. *General Electric Co, Schenectady, N.Y.*

WELDING ELECTRODE—For small ac transformer-type arc welders, "Transweld" electrode has heavy extruded coating and stable arc. Tensile strength is 75,00 to 85,000 lb per sq in., yield point 60,000 to 68,000 lb, and ductility of 20 to 30% elongation in 2 in. *Lincoln Electric Co, Cleveland, Ohio.*

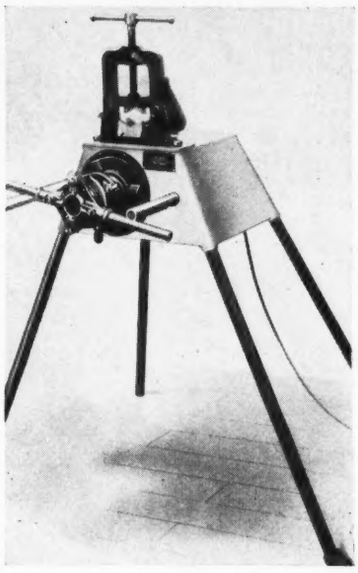
WELDING ELECTRODE—"Fleetweld No. 9 HT" developed for welding high-tensile steels of 70,000 to 80,000 lb per sq in. Physical properties of weld deposits, stress relieved at 1200 F are approximately: tensile strength, 70,000 to 76,000 lb psi; yield point, 58,000 to 63,000 lb psi; % elongation in 2 in., 27 to 32. Two sizes, 3/16 and ¼ in., 18-in. lengths. *Lincoln Electric Co, Cleveland, Ohio.*

WELDING PROCESS—"Unionmelt" electric welding process said to provide a speedy and automatic method of making butt welds, fillet and plug welds of exceptional quality and high strength in any commercially used thickness of low and medium-carbon steels, high-strength steels, and stainless and other alloy steels. End of electrode is constantly covered by a highly resistant, conductive granulated medium known as Unionmelt welding composition. This granulated material is laid down along seam to be welded, and entire welding action takes place beneath it, without open visible arc, and without sparks, spatter, smoke or flash. *Linde Air Products Co, 30 E 42nd St, New York, N.Y.*

UNFUSED MELT RECOVERY SYSTEM—Apparatus for recovery of unfused melt (see welding process described in description immediately above) consists of cast-iron pickup tool, suitable length of pipe and wear-resisting, wire-reinforced hose, a compact rubber-lined melt collector and motor-driven exhauster mounted on top of and drawing through collector. *B F Sturtevant Co, Hyde Park, Boston, Mass.*

BURN-OUT-PROOF WELDERS—Line of high-efficiency welders has transformer coils wound with heat-proof, burn-out-proof, glass-insulated magnet wire. Leader of this new line is Type 120-UL, which has wide range of welding heats—from 20 to 120 amp. Operates on either 110- or 220-volt ac. *Commonwealth Mfg Corp, 4208 Davis Lane, Cincinnati, Ohio.*

WRENCHES AND OTHER TOOLS



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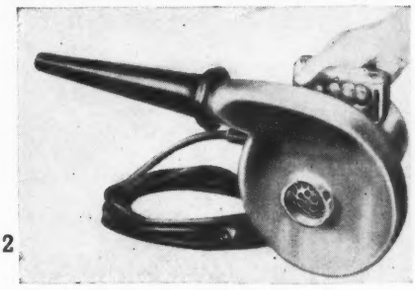

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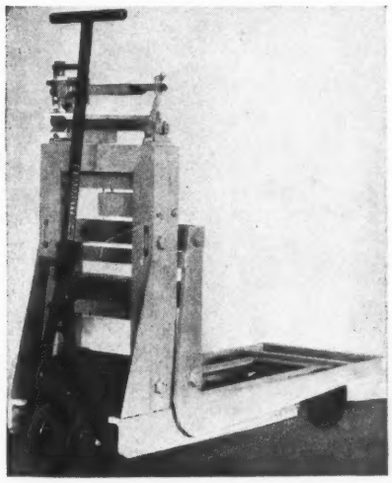

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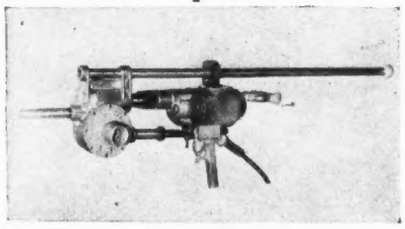

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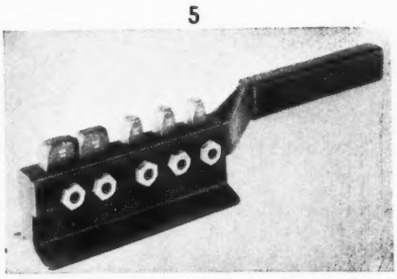

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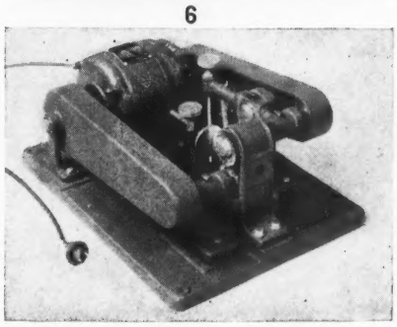

1 PIPE VISE STAND—Motorized pipe vise stand enables user to thread, cut and ream pipe up to 2 in., by power. Pipe is gripped in a universal, bar-operated, scroll-type chuck and is revolved by power unit concealed in inner part of stand. Die stock, cutter or reamer is placed on pipe in conventional manner with handles resting on sliding arms that are built into sides of stand. Net weight 11 lb. *Oster Mfg Co, 2057 E 61st Place, Cleveland, Ohio*

2 ELECTRIC BLOWER — Improved "Tornado" portable electric blower has new bearing construction to increase motor life. Miners gauze over air-intake holes in housing prevents damage to motor in excessive dust and dirt. For removal of dirt from motors, machinery, etc. *Breuer Electric Mfg Co, Chicago.*

3 SCALE TRUCK—Combination of beam scale and lift truck, for 3500 and 500 lb capacity has these features: scale levers mounted in vertical steel frame away from dust and dirt; liberal working clearances for scale levers; open-face poises with center reading; scale-platform check bars fitted with double-shield ball bearings. *Barrett-Cravens Co, 3255 W 30th St, Chicago, Ill.*

4 POWER WRENCH — Portable power wrench has worm-gear drive operated by any standard electric drill of ½-, ⅝- or ¾-in. size. Even pull and high starting torque make it applicable to winches, hoists, gates, valves and intermittently-operated machinery. Electric drill is rigidly clamped in place when operating wrench, but can be detached quickly when drill is needed. *W. C. Lipe Inc, Syracuse, N. Y.*

5 PIPE MAKER—Holder No. 63 holds steel stamp in place while marking steel pipe, bar, cylinders and other round objects. When several stamps are used, unit holds them in alignment. Stamps have "Safe-Hed" and "Tuf-Face" features, result of special heat treating and quenching. Stamps are grooved on one side and held in place by turnscrew. *J H Matthews & Co, 3942 Forbes St, Pittsburgh, Pa.*

6 WIRE STRIPPER — Motorized brush-type wire stripper cleans and strips cotton-, silk-, enamel-, string- and asbestos-covered wire, fine "litz" wire and removes gummy insulation embedded in standard wires. A thumb-adjustment screw varies distance between brushes for various sizes of wire. *Ideal Commutator Dresser Co, 1025 Park Ave, Sycamore, Ill.*

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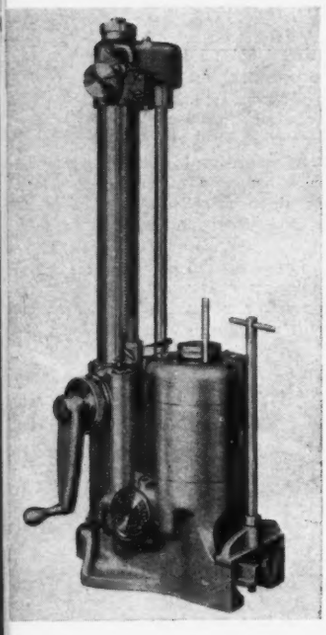

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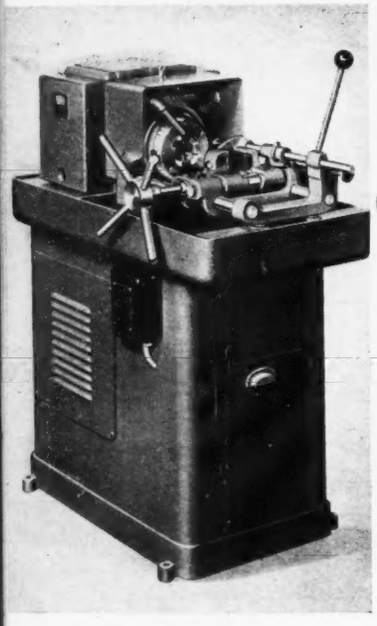

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1 OILING CAN—"Scan Can" is molded from transparent plastic, not affected by oil, gasoline, etc. Heavy-gage copper-plated spout can be unscrewed from body of can. Weighs less than metal can of same capacity and user can see at any time how much oil is in can. *Universal Plastics Corp, 235 Jersey Ave, New Brunswick, N.J.*

2 TORQUE-INDICATING WRENCH — No. 66 torque-indicating wrench permits drawing up all bolts evenly to avoid leaks. Indicator is set at desired torque in ft lb. Wrench is operated as any ratchet wrench until ratchet lever snaps to neutral position in center. A sharp click is heard and ratchet locks as further indication that desired torque has been reached. *Bonney Forge & Tools Works, Allentown, Pa.*

3 WIRE STRIPPER—Automatic stripper has lever which stops return of arms until wire is removed after stripping, then is snapped quickly back to normal. Protects operator's hand and prevents nicking, cutting strands and waste of wire. Clamps, cuts insulation and automatically strips wire with one queeze of handles. *Ideal Commutator Dresser Co, 1025 Park, Sycamore, Ill.*

4 PORTABLE BORING BAR—"Per-Fect-O" No. 777 will take large cuts at high speeds, yet is light enough for one man to handle. Will bore or sleeve any diameter from 2.6 to 5.343 in., and has ample power throughout range. Machine is complete unit, has two feeds and two speeds, takes 0.05-in. cut at any diameter within its capacity. Heavy-duty tool bits are standard equipment. *Van Norman Machine Tool Co, Springfield, Mass.*

5 IMPROVED WRENCHES—Complete line of carbon-steel wrenches made in 50 patterns and more than 1000 sizes. Drop-forged from improved quality carbon steel and said to be about twice as strong as old-fashioned, case-hardened wrenches. Other advantages claimed are: better hand grip and greater and safer bearing on nut. *J H Williams & Company, 75 Spring Street, New York, New York.*

6 BOLT MACHINES—"Rapiduction Junior" bolt-threading machine made in two sizes: No. 541 has capacity covering all sizes to 1¼ in., and No. 542 to 1½ in. When stripped of die-head and vise carriage, machines can be adapted to chamfering, drilling, reaming, boring, tapping and other jobs. Machines are powered by 2-hp, 1800-rpm constant-speed motors, and speed changes are obtained with pick-off sheaves. Drive from motor to machine is through V-belt. Eight spindle speeds are obtainable from 27 to 386 rpm. Final drive is by triple worm thread, hardened and ground steel, and running in anti-friction bearings. *Oster Mfg Co, 2057 E 61st Place, Cleveland.*

7 TEST PLIERS—Insulated test pliers, for 110 to 600 volts, has removable tungsten lamp. This instrument locates dead circuits, and then can be used to remove blown fuse. Prongs on grip end of pliers test base receptacles. *Star Fuse Co, Inc, 235 Canal St, New York, N.Y.*

8 RATCHET HANDLE — Reversible ratchet handle, for ⅜-in. square-drive sockets and attachments, has ¼-in. square opening on other side of head for ¼-in. adapters or for small compressors, motors, shutoff valves. Made of chrome-vanadium steel, chromium-plated and highly polished. *Bonney Forge & Tool Works, Allentown, Pa.*

9 MAGNAFLUX INSPECTION UNIT—Type T-110 portable Magnaflux unit for inspecting turbine blades in position consists of an oval-shaped solenoid which, in use, is placed over ends of a segment of blades to set up a magnetic field in a longitudinal direction with respect to blades. Solenoid is flexible so that it can be adjusted for various spacings of blade rows or disks. Power unit with open coil provides direct-current field from either dc or ac source of supply, and consists of resistance unit and rectifier. *Magnaflux Corp, 25 W 43rd St, New York, N.Y.*

FOR FURTHER INFORMATION

Use this coupon to obtain manufacturers' bulletins and other descriptive material on the new-equipment items covered in this review. Indicate below the items on which you wish further information. POWER will do the rest with as little delay as possible.

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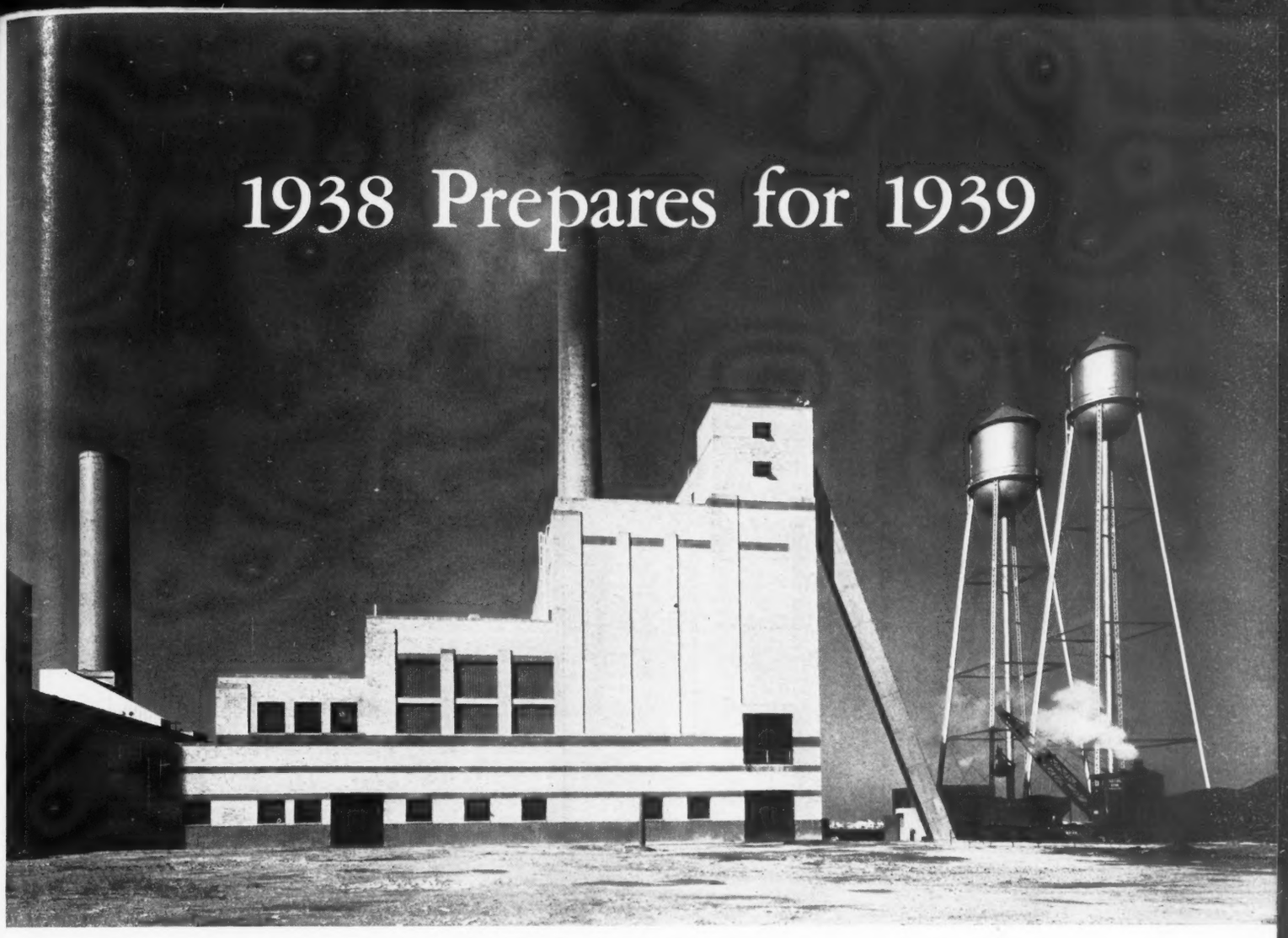
1938 Prepares for 1939



Industrial Rayon Corp's new plant, Painesville, Ohio will produce 15,000 kw and 270,000 lb of steam per hr

Such events as turbine standardization, embrittlement progress, stored refrigeration, electronic instruments, and power coordination for defense tune up men, ideas, equipment and design for the faster pace of the year ahead

IF NEW capacity ordered or completed were the only measure, 1938 would not be an impressive year in the field of utility steam power. The tabulation on pages 78–79 clearly shows the combined effect of the general business slump and the specific utility problems of financing and government competition. Yet steam-plant technique advanced notably. By study, and by operating experience with recently completed radical designs, both builders and owners have learned much.

Topping installations still dominate. The run of new topping turbines take steam at approximately 1200 lb, 900 F, and exhaust at 200 to 300 lb. Yet topping steam conditions range from 750 lb and 850 F to 2400 lb and 940 F.

Today's condensing installations show steam conditions ranging from 450 lb and 825 F for a small, low-load-factor, cheap-fuel plants through 650 lb and 825 F, 850 lb and 900 F to 1200 lb, 900 F.

Industrial Steam

Topping continues actively in the industrial field, but generally at much lower pressures than the typical 1200 lb of the central stations. Steam temperatures, also, are generally in the 600–800 F range.

Whereas load growth controls utility-capacity expansion, the primary factor in most industrial-plant installations is the opportunity to obtain a very high return on investment by replacing long-obsolete equipment and hookups. The usual procedure is to modernize steam-generating equipment and at the same time raise boiler pressure to reduce waste of steam to condenser or atmosphere.

Boilers

A slower rate of change in boiler design has given builders and operators an opportunity to overcome various initial troubles experienced with recent installations. The smaller steam-water density differential has made it more difficult to secure proper circulation and steam separation. Troubles encountered with new units included, also, a variety of difficulties with ash and slagging. Most of these have been cured by minor structural changes.

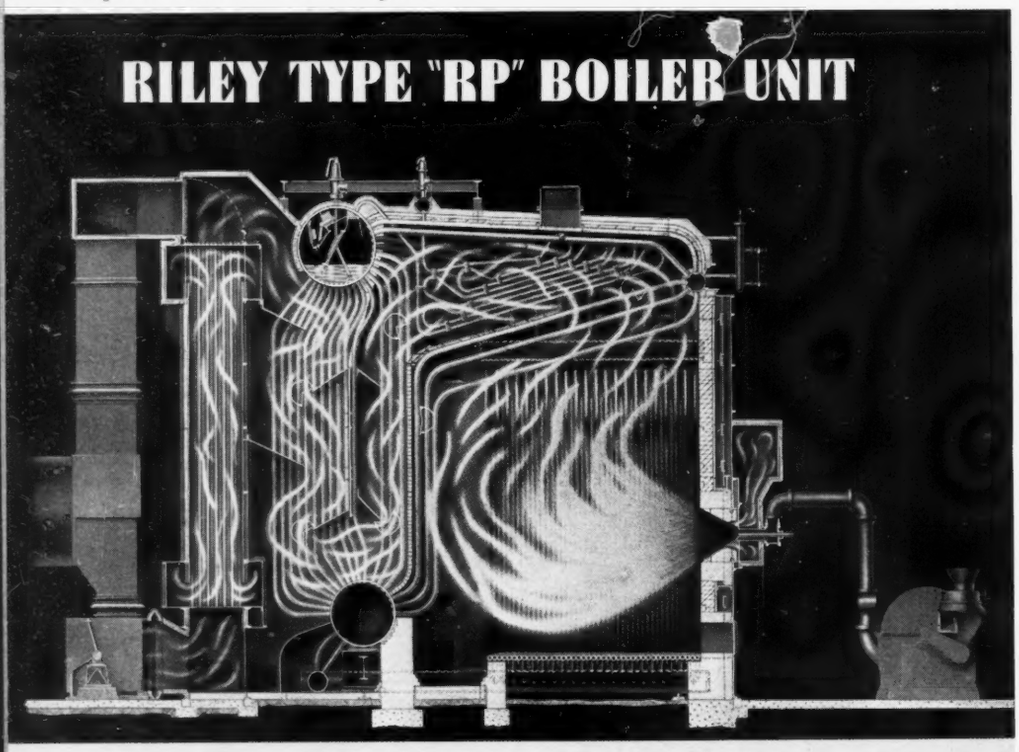
No important installations of once-through boilers have yet been made in this country. Yet in Europe the Benson boiler, to take one example, has over 80 units installed or under construction. The decreasing effectiveness of natural circulation with rising pressure makes it probable that most future U.S. boiler installations for 2400 lb and up will be of the once-through type or forced-circulation.

THESE ARE ACTUAL OPERATING EFFICIENCIES

*87% - 85.2% - 86.6% - 85.7%

PERFORMANCE WHICH ASSURES LARGE SAVINGS

*Complete Test Data on Request



For Capacities between 40,000 and 150,000 lbs. per hour
THE RILEY TYPE "RP" STEAM GENERATING UNIT

SUCH results . . . results which in most cases exceeded guaranteed performance . . . definitely establish the Riley "RP" Boiler Unit as a most efficient unit. Because of these excellent performance characteristics of existing Riley "RP" units, companies which install these units are assured of unusually large savings in steam production costs. High efficiencies being obtained from Riley "RP" units result from their distinctive design. This design also makes possible units of comparatively low investment cost.

A List of Recent Riley "RP" Boiler Installations

Natrona Pr. & Lt. Co., Natrona, Pa.
1—90,000 lbs./hr.—450 lbs.

Brisban Co., S. J., South America
1—36,000 lbs./hr.—450 lbs.

Central Ohio Lt. & Pr. Co., Bluffton, O.
2—60,000 lbs./hr.—450 lbs.

Union Public Service Co., Canby, Minn.
1—60,000 lbs./hr.—500 lbs.

Lexington Water Works, Lexington, Ky.
1—15,000 lbs./hr.—325 lbs.

Riverside Metal Co., Riverside, N. J.
1—65,000 lbs./hr.—450 lbs.

Crown Cork & Seal Co., Baltimore, Md.
1—90,000 lbs./hr.—200 lbs.

General Aniline Co., Rensselaer, N. Y.
1—80,000 lbs./hr.—250 lbs.

Port Huron Sulphite and Paper Co., Port Huron, Mich.
1—80,000 lbs./hr.—675 lbs.

American Bridge Co., Trenton, N. J.
2—35,000 lbs./hr.—275 lbs.

Newport Elec. Corp., Newport, R. I.
2—60,000 lbs./hr.—475 lbs.

Winchester Repeating Arms, New Haven, Ct.
2—75,000 lbs./hr.—725 lbs.

Barrett Co., Philadelphia, Pa.
1—80,000 lbs./hr.—450 lbs.

Lewiston Bleachery, Lewiston, Me.
1—70,000 lbs./hr.—450 lbs.

Humble Oil & Ref. Co., Ingleside, Tex.
1—40,000 lbs./hr.—400 lbs.

Bemis Bros. Bag Co., Peoria, Ill.
1—70,000 lbs./hr.—275 lbs.

Hellwig Silk Dyeing Co., Philadelphia, Pa.
1—100,000 lbs./hr.—475 lbs.

Western Cartridge Co., E. Alton, Ill.
2—75,000 lbs./hr.—725 lbs.

Suchar Process Corp., Yonkers, N. Y.
1—60,000 lbs./hr.—250 lbs.

Great Lakes Steel Co., Detroit, Mich.
2—100,000 lbs./hr.—450 lbs.

Northern Paper Co., Green Bay, Wisc.
2—75,000 lbs./hr.—700 lbs.

Wheeling Steel Co., Portsmouth, Ohio
1—100,000 lbs./hr.—660 lbs.

Guide Lamp Co., Anderson, Ind.
1—50,000 lbs./hr.—275 lbs.

N. Da. Power & Light Co., Bismarck, N. D.
2—35,000 lbs./hr.—450 lbs.

Yazoo Municipal Plant, Yazoo, Miss.
1—60,000 lbs./hr.—275 lbs.

Hartford City Paper Co., Hartford City, Ind.
1—55,000 lbs./hr.—350 lbs.

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St. Louis Cincinnati Houston Chicago St. Paul Kansas City Los Angeles Atlanta Memphis New Orleans

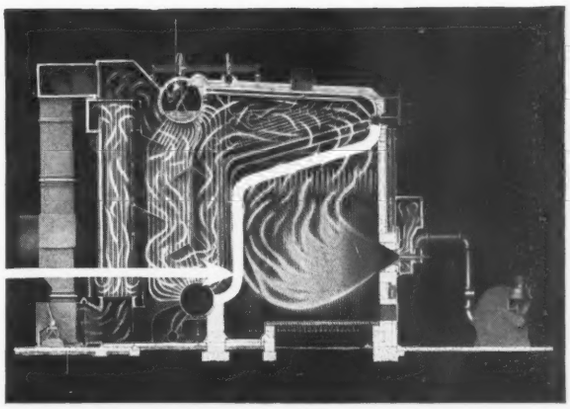
It will pay you to visit modern Riley Installations

BEING OBTAINED FROM RILEY "RP" BOILER UNITS

88.7% - 86.1% - 85% - 87.3%

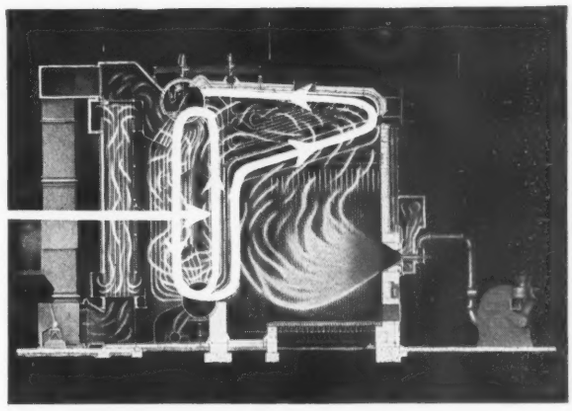
TO COMPANIES INSTALLING RILEY "RP" BOILER UNITS

and here are a few of the many reasons why Riley "RP" units give such excellent performance . . . .



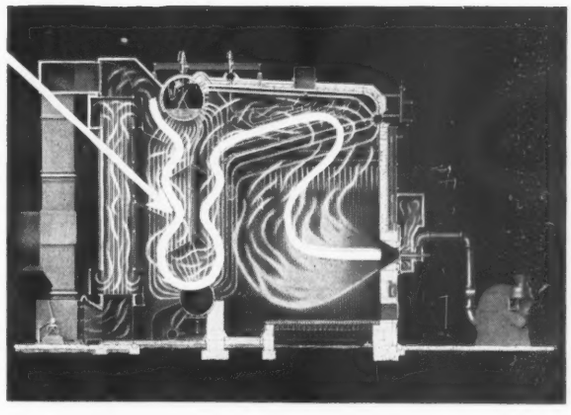
Unique Design of First Tube Bank

Much of the efficient performance of Riley "RP" Boilers can be attributed to the unique shape of the first tube bank. This design makes possible the most effective heat transfer. Together with the method of baffling, it eliminates stratification of gases, gases passing over every square foot of tubes, making each square foot effective. The front tubes contain at least twenty per cent more heating surface than if merely straight tubes connected the drum and header. This gives the greatest possible amount of heating surface, where it does the most good . . . subjected to radiant heat of furnace. This design also creates a furnace not only of the greatest possible volume for a given height but also of proportions which makes possible utilization of every cubic foot . . . note how completely the flame fills the furnace. Low flue gas temperatures and high efficiency result.



Rapid Positive Circulation

Water circulation with Riley "RP" Boilers is unrestricted, well defined and in a fixed direction at all steaming rates, rapidity of circulation increasing with load increases. Water definitely flows upward in tubes over which the hottest gases pass. The distance between lower and upper drums creates a large hydrostatic head, creating rapid circulation. Rapid circulation assures immediate removal of steam bubbles as formed, keeping water in intimate contact with tube surfaces at all times, affording highest heat transfer rates, lower flue gas temperatures and higher efficiency.



Cross Flow of Gases

Riley "RP" units are fired from the front with gases passing uniformly over the entire heating surface. With proper baffling this assures distribution of gases over the entire convection surfaces with no possibility of by-passing of surface at low ratings. Baffling is arranged to give cross flow of gases. Cross gas flow gives high heat transfer rates, resulting in low flue gas temperature and high efficiency.

• • •

In addition to operating at high efficiency, Riley "RP" units are capable of carrying extreme load variations, with freedom from objectionable water carry-over and with unusually steady water level. Their design assures low maintenance and trouble free performance.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

efore purchasing Boiler or Fuel Burning Equipment

Boiler feedwater conditioning is still "unfinished business", but progress is rapid. A notable new development of the year is the new non-siliceous zeolite. When regenerated by common salt, it acts like the traditional zeolite, replacing hardness with sodium salts. Regenerated by acid, it becomes a "hydrogen zeolite" which not only softens but reduces total alkalinity. Recommended particularly for high-pressure boilers, a combination of the two zeolites simultaneously softens, reduces total alkalinity and controls pH value.

Recent research shows that ASME ratios for preventing embrittlement do not hold for high pressures. Important announcements regarding the effects of silica, lignins, common salt, R_2O_3, etc, are expected soon.

Turbines

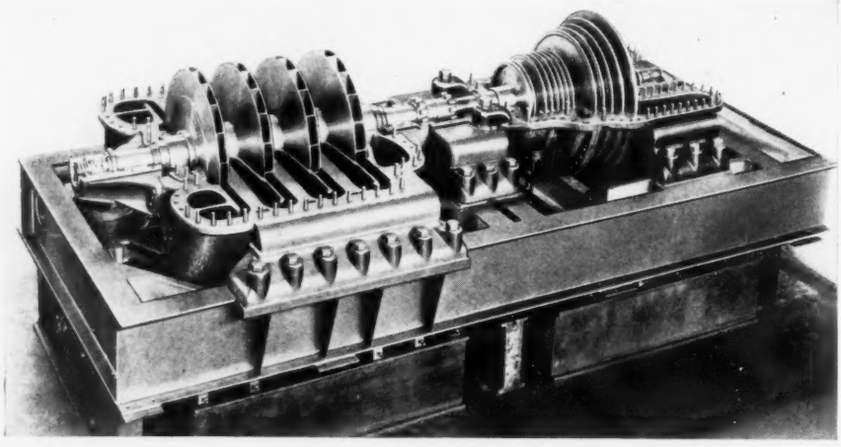
While some troubles have been experienced with high-pressure, high-temperature turbines, their complete and early solution seems assured. Major improvements have been made in design of high-pressure blade roots and in tapering low-pressure blading of 3600-rpm machines.

Industrial turbines have been notable chiefly for the immense variety of arrangements to meet special conditions—innumerable combinations of throttle pressure and temperature, bleed, backpressure, mixed pressure, condensing—also provision for radical future changes of pressure and even of type after installation.

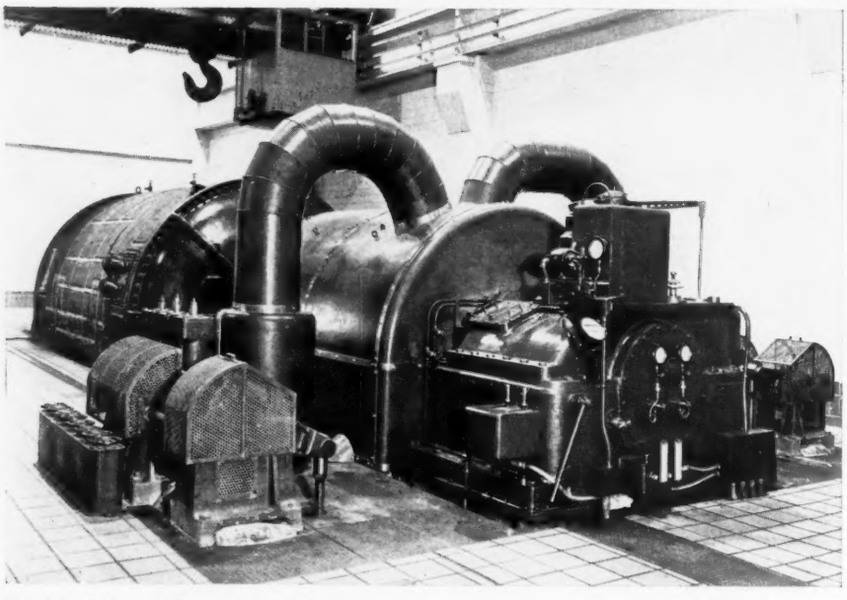
Condensers

While few condensers were ordered or installed during the year, a rapid increase in condenser business seems certain in the near future from the combined effect of expanding utility capacity and an increasing percentage of new condensing units as topping opportunities are used up.

Condenser-tube research is directed largely toward modifying new and tested tube materials by adding elements to inhibit corrosion. Cupronickel and aluminum bronze are finding wider application. Equally important are changes being made in condenser water-box design to prolong tube life.



Performance of this 75,000-cfm centrifugal blower in a Midwestern steel plant led to ordering a similar unit of 85,000 cfm. The blower has 30-lb backpressure and runs at 2800 rpm at full load; steam conditions at turbine throttle are 400 lb, 700 F



Double-shell turbine, 50,000 kw, 1250 lb 950 F at Essex Generating station of the Public Service Electric & Gas Co of N. J. Exhausts at 235 lb; generator is 3600 rpm

Electrical Equipment

The year's outstanding electrical-machinery contract totaled $2,627,970 for 3 main and 2 service generators for Grand Coulee. The main generators, rated 108,000 kw at unity power factor, weigh 1000 tons each, are 24 ft high and 45 ft in diameter. Two additional generators (82,500 kw at unity power factor) ordered for Boulder Dam, will bring its installed capacity to 700,000 kw. In all, 28 hydrogen-cooled generators, totaling 1,250,000 kva, have been ordered in the past three years. In sizes from 6,250 to 60,000 kva, they operate at 3600 rpm, larger sizes at 1800.

To insure against gas or vapor explosions, one oil refinery installed two 1000-hp, 3600-rpm totally inclosed induction motors, cooled by recirculated inert gas at pressure slightly above atmospheric.

Designers of power mercury-arc rectifiers have concentrated on reducing arc drop in units for low and medium voltage. Grid controls have been further improved. Means have been developed to increase the number of phases of multiple-unit rectifier installations and reduce communication interference to a negligible value.

During 1938 the first 50-kw incandescent lamp was installed in commercial service to simulate sunlight. A line of fluorescent lamps with three to ten times the efficiency of Mazda lamps was announced. In these units an arc is maintained between electrodes in ends of evacuated glass tubes.

Water Power

The year has seen notable water-power activity, chiefly in governmental projects. About 750,000 hp has gone into service, raising the national total to around 18,000,000. In addition, manufacturers are now working on orders for another 1,000,000 hp, not counting orders about to be placed for 500,000 hp for Grand Coulee.

Work was started on the Shasta Dam project, California; initial installation will call for 400,000 hp. Other large contracts to be let soon include Elephant Butte, New Mexico (34,500 hp) and Green Mountain, Colorado (30,000 hp). A power installation (100,000 hp, ultimate) is being considered for Fort Peck Dam, Montana. Santee-Cooper project, N.C. (200,000 hp, ultimate) and Colorado-Big-Thompson project (135,000 hp, ultimate) were also started.

The tables on pages 82 to 85 show that utilities and industrials also have been moderately active in water power. Utility projects include four 26,000-hp units being installed by Appalachian Electric Power Co, Rocky Mountain Power Co's 70,000-hp unit, and other units (for example: in Maine, Vermont, New York, Wisconsin) now finished or under construction.

Naturally the government leads in new capacity. Such projects, completed and started, represent an ultimate of 9,000,000 hp or one half the present national water-power total. Of this the Bonneville and Grand-Coulee plants on the Columbia River will account for nearly 3,500,000 hp, Boulder Dam 1,835,000 hp, various California plants 526,000 hp, TVA nearly 2,000,000 hp, miscellaneous about 1,000,000 hp. The TVA total includes space for 620,000 at Wilson Dam built before birth of TVA. To date, only 1,631,500 hp has been installed in government-financed projects (including 260,000 hp in Wilson Dam plant) with another 1,387,000 hp on order.

At Grand Coulee, for the first time, scroll cases are of arc-welded steel plate. Significantly, the James F Lincoln Arc Welding Foundation has awarded first prize ($3765) to A A Seipel of the Bureau of Reclamation for his paper on arc welding of scroll cases and third prize ($1528) to L M Davis and J M Mousson of the Safe Harbor Water Power Corp for their paper on prewelding of turbine blades of high-capacity propeller units.

During the year, two more 115,000 hp units were ordered for Boulder Dam. The reservoir now contains 23,000,000 acre-ft and in another year may reach its capacity of 30,500,000 acre-ft.

Steam—Hydro

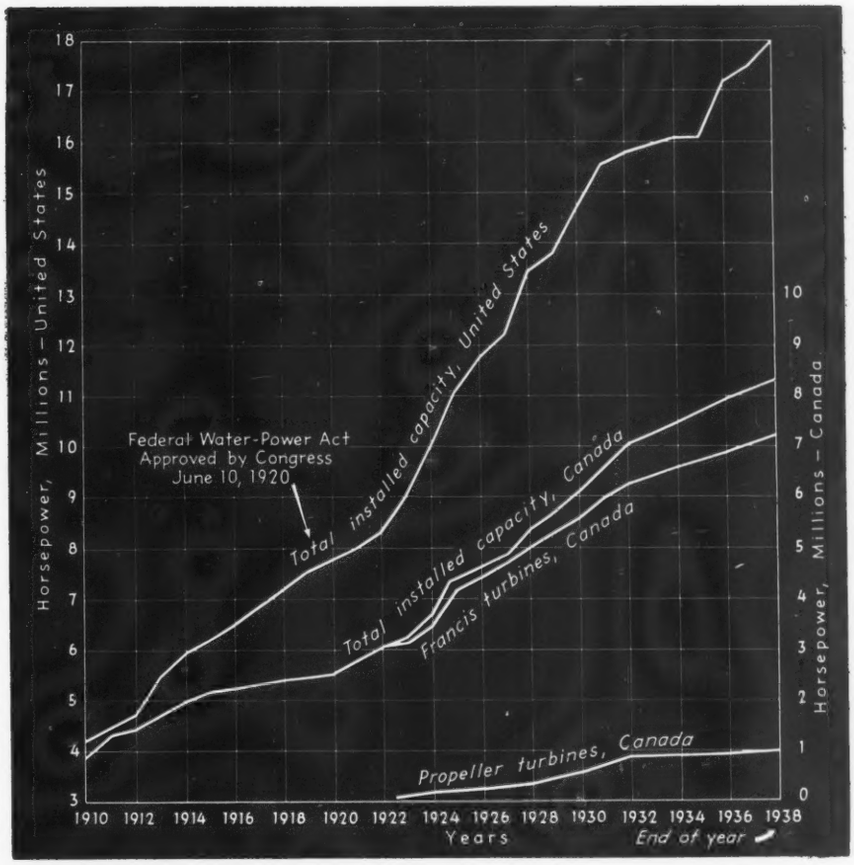
Contrary to popular opinion, the vast governmental activity in hydro has had little direct effect on steam-plant construction. Tennessee Valley is the main exception. Elsewhere the projects are mainly in the mountain and Pacific States, which have always depended largely on water power. It is worth noting, also, that total hydro capacity increased 5,500,000 hp from 1926 to 1931, but only 3,500,000 from 1932 to 1938 when the government was most active in this field.

The curves in the power chart (Federal Power Comm figures, except estimates for last quarter of 1938) show power generated by private- and publicly-owned utilities, electric railways, Bureau of Reclamation and other public-service agencies. Note that water power supplied 36% of the total energy of 1937, the same proportion as in 1920.

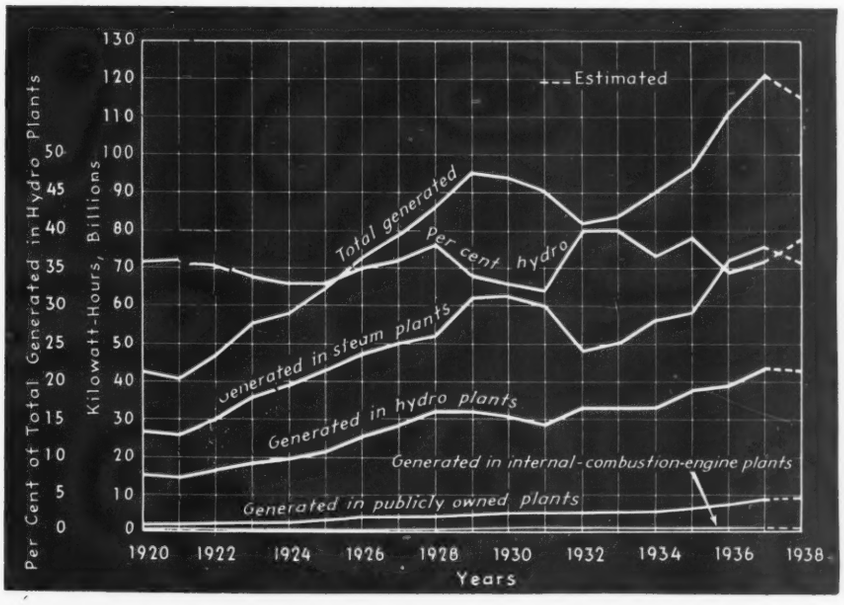
For peak-load service on an irrigation system that includes several water-power plants, the Salt River Valley Water Users Assn, Ariz., installed two 7000-hp (5000-kw) diesel-generating units with room for a third. These units, largest installed in the U.S. in recent years, are equalled only by those at Vernon, Calif.

Technical trends in diesel plants include pioneer applications of evaporative "condensers" as coolers in closed circulation systems. New methods of refining have increased yield of gasoline and cut supply of fuel oils. One result of refining changes and efforts at standardization is a tendency to decrease the number of oil classifications and to take diesel oils definitely out of the "byproduct" class.

Gas-engine power has advanced rap-

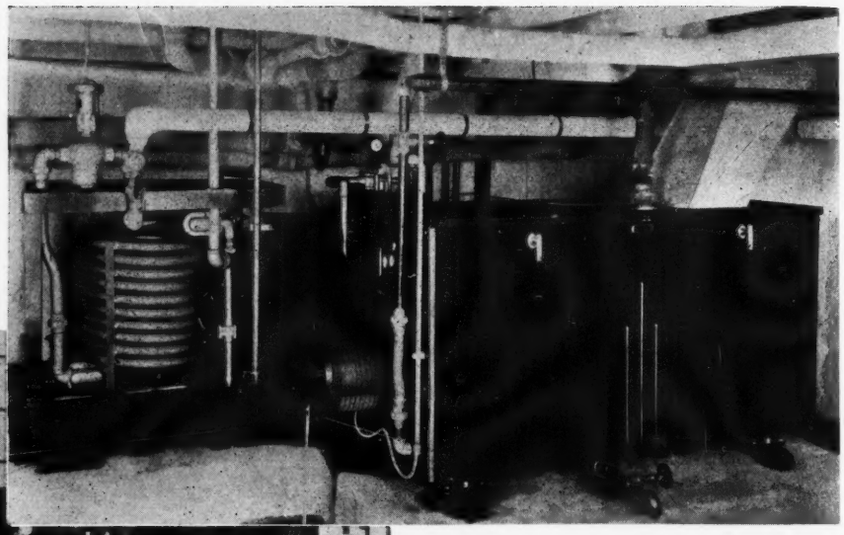


Growth of hydro generating capacity (all types) in the U. S. and Canada

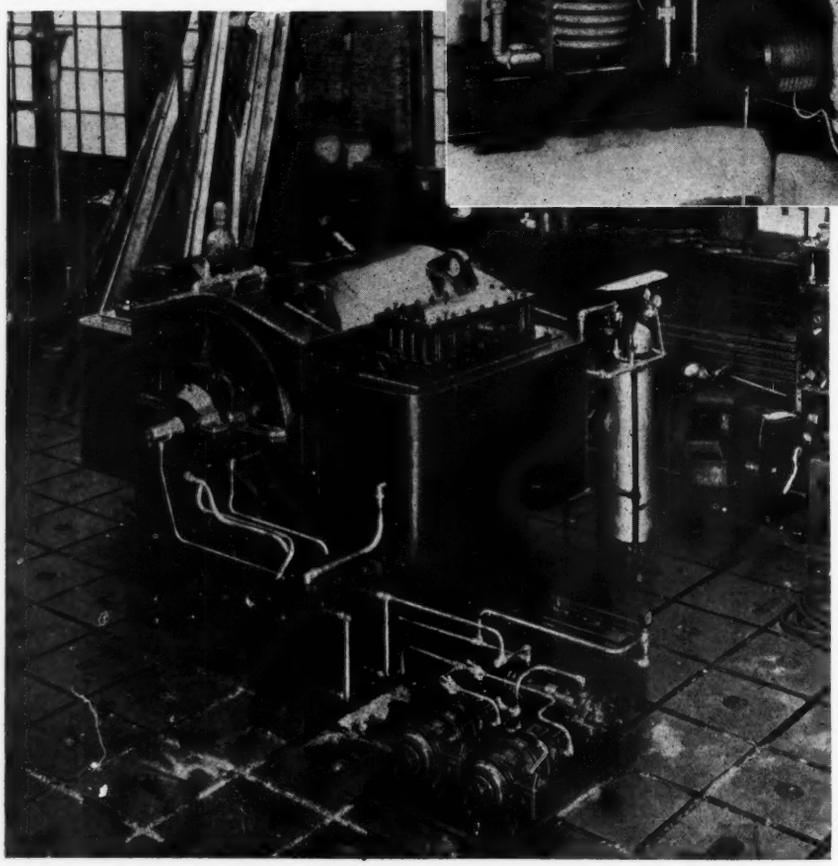


Comparison of yearly energy output by steam, hydro, and internal combustion in all publicly and privately owned central stations

Gas engine drives air-conditioning compressor in Chicago Store of Peoples Gas Light & Coke Co



Oil refinery installs unique explosion-proof, inert-gas-filled, squirrel-cage induction motor—1000 hp, 3600 rpm, 2300 volts, with surface coolers



idly, with the spread of natural-gas pipelines. Panhandle gas is now carried east as far as Philadelphia. Reporting 1938 (1937 data), the gas-engine committee of the American Gas Assn says that natural gas is now driving about 500,000 hp of engines in Southern California (about 100,000 hp industrial). Application in the Southwest has been even greater. More and more diesels can be converted quickly to gas to utilize whichever fuel is most economical in each year or season.

Blowers, Compressors

Compressors are now available with unlubricated, full-floating, carbon-ring-sealed pistons to deliver oil-free air for special process use. Largest blower of the year was an 85,000-cfm centrifugal unit for a large Mid-West steel company. Steam-turbine driven, it runs 2800 rpm at full load and is governed to give constant delivery to the blast furnace.

Air conditioning load, whether supplied by a utility system or an isolated plant, is usually peak load, which means that air-conditioning power is high-cost power. This situation has focused attention on means of storing refrigeration to smooth out the load curve. Although commonly thought to be uneconomic, installations in St. Louis and other parts of the country suggest a real future for storage of refrigeration by means of ice, which is melted as needed by the air-conditioning system.

Pumps

Largest pumps on order to date are those now finished (to be installed in 1939) for the 5 pumping plants of the Metropolitan Water District of Southern California. Each station will contain 9 pumps of 90,000 gpm each. Cumulative lift of five plants is 1660 ft, total motor power 400,000 hp. Much larger pumps have been proposed for the Grand Coulee Irrigation District.

Smaller, but possibly more interesting to steam engineers, are the feed pumps now being built for high-pressure boiler service. The feed pump is a crucial point in high-pressure plants and designers have made many improvements to increase efficiency and avoid overheating, excessive wear, etc.

Piping and Valves

Today's commercial limit of steam temperature is 950 F, set chiefly by materials available for piping and valves. Manufacturers state turbines can be built safely for 1000 F. A rise from 900 F to 950 F requires a reduction of 20 per cent in the design unit stress for valves and piping and therefore is attained at considerable cost. From present indications further progress in steam temperatures above 950 F will be very slow.

Power For Defense

Power problems figured prominently in discussions of national defense toward the end of the year. On Sept 3 the President appointed a committee, headed by Assistant Secretary of War Johnson, to study the problems of electric power as they touch on national defense. Recalling many local power shortages in the World War, this committee was instructed to plan action to avoid them if another war comes. On October 28, Secretary Johnson announced definite commitments by the utility industry to order generating equipment for 1,000,000 kilowatts. Some utility executives predicted that actual yearly expenditures for power equipment (including transmission and distribution) may reach $500,000,000 to $700,000,000 yearly, if business maintains its upward trend.

The National Defense Committee is also actively considering additional inter-connections between various systems in the industrial areas to alleviate

possible local power shortages under war-time conditions.

Of outstanding interest and importance to all steam engineers was the release on Nov 14, of "Preferred Standards for Steam Turbine Generators" by the Subcommittee on Standardization of the National Power Defense Committee. This news is given in some detail on page 110. It is important to note here that a group representing the government, the large manufacturers of turbines and the utilities have agreed on a set of standards, and that these standards (within the range from 10,000 to 100,000 kw fix sizes, speeds, pressures, temperatures, voltages, bleed points, bleed pressures, and so on.

The Standards

Table 1 gives these standards in full. Note that the turbine sizes listed are the only ones permitted (see news story for exceptions). Note also that all condensing turbines up to 50,000 kw are to be 3600 rpm, that those up to 15,000 kw operate at 650 lb, 825 F, with three bleed openings.

The only important choice permitted anywhere in the table is between 850-lb and 1250-lb throttle steam for condensing turbines from 35,000 kw to 100,000 kw. All topping units are to be 1250 lb, 925 F.

Obviously this table is news of exceptional interest. Moreover, it would seem to fulfill the long-felt desire of many engineers that equipment costs be lowered and deliveries speeded by elimination of excessive "tailor-making".

So far, the news releases leave the impression (by omission) that the National Defense Committee has overlooked the first line of defense for the power supply of its key industrials—namely the plants already in these industrials, on the spot and freed from all worries about transmission and interconnection. The existence of such industrial power plants, modern and well maintained, is the best possible insurance against a stoppage of production.

The Power Field

The following forecast of general business for 1939 is based on what *Power* believes to be an authoritative economic analysis.

Starting at a low point on June 18, 1938, general business had expanded 30% on a broad front by the end of October. The upward pace is maintained at this writing and is practically certain to continue until the middle of next summer—possibly much longer. Starting in the light industries (consumer goods) the revival is now swinging to the heavy industries, also.

To finance a substantial recovery, bank deposits are at a high level, interest rates are low and banks are anxious to lend. The government, through FHA and RFC, is also ready to provide business with capital.

Utility Loads

Granting the correctness of this analysis, utility power loads should feel the double effect of their normal growth and of general business improvement. Present capacity margins are narrow; just how narrow is a matter for debate. At the very minimum, safety requires that orders for added capacity must keep pace with any further load growth. The national-defense program should give added impetus.

As always, when general business picks up, industrial-plant modernization will become far more active. There seems a possibility that the combined utility and industrial orders will load some of the equipment manufacturers rather heavily, with a resulting rise in prices and lengthening of deliveries.

On the basis of this analysis, it has been recommended that any improvements planned for the next year or two should be started at once to get the best deliveries and prices, and also assure ample capacity for peak demands in both industrial and utility plants.

NATIONAL DEFENSE POWER COMMITTEE, SUB-COMMITTEE ON STANDARDIZATION

PREFERRED STANDARDS FOR STEAM TURBINE GENERATORS

TABLE 1 — CONDENSING TURBINES

Item No.	GENERAL: All sizes–backpressure 1 or 1½ in. Hg Abs; Short-circuit ratio 0.9; Generator voltage 13,800; Excitation voltage 250.									
1	Rating — Kw	10,000	12,500	15,000	20,000	25,000	35,000	50,000	75,000	100,000
2	Rpm	3,600	3,600	3,600	3,600	3,600	3,600	3,600	1,800	1,800
3	Throttle pressure Lb gage	650	650	650	850	850	850 or 1,250	850 or 1,250	850 or 1,250	850 or 1,250
4	Throttle temperature, F	825	825	825	900	900	900	900	900	900
5	No. of extraction openings	3	3	3	3	3	4	4	4	4
6	Temp. at extraction openings, plus or minus 10 F (at rated output)	170 225 290	170 225 290	170 225 290	170 225 290	170 225 290	170 225 290 350	170 225 290 350	170 225 290 350	170 225 290 350
7	Turbine capacity in % of kw rating	125	125	125	125	125	125	125	125	125
8	Power factor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
9	Generator cooling (Air or hydrogen)	A	A	A	A	A or H	H	H	H	H

TABLE 2 — SUPERPOSED TURBINES

	GENERAL: All sizes — 3600 Rpm; Throttle steam 1250 lb gage, 925 F; Backpress. 200–300 lb gage; Short-circuit ratio 0.9; Generator voltage 13,800; Excitation voltage 250.								
10	Rating — Kw	10,000	12,500	15,000	20,000	25,000	35,000	50,000	60,000
11	Turbine capacity, % of kw rating	111	111	111	111	111	111	111	111
12	Power factor	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8 or 0.9
13	Generator cooling (Air or Hydrogen)	A	A	A	A	A or H	H	H	H

Central Stations and Municipal Steam Plants

Compiled by S A Tucker
Associate Editor

Company	Location	Plant Name	First Operation, New Units	Pressure, Lb	Steam Temperature, F	BOILERS					FURNACE			
						Number	Capacity, Each 1000 Lb per Hr	Straight- or Bent-Tube	Boiler Surface, 1000 Sq Ft	Superheater Surface, 1000 Sq Ft	Waterwall Surface, 1000 Sq Ft	Volume, 1000 Cu Ft	Bottom, Dry or Slag-Tap	Heat Liberation, 1000 BTU per Cu Ft
ABOVE 1000 LB														
Indiana & Michigan Electric Co	Mishawaka, Ind	Twin Branch	1940	2400	940	1	550	....	....	....	....	....	ST	....
Pacific Gas & Electric Co	Avon, Calif	Avon	9-39	1500	950	3	200	B	1.5	5.9	2.5	8.0	ST	30.0
	Martinez, Calif	Martinez	10-39	1500	950	3	200	B	1.5	5.9	2.5	8.0	ST	30.0
	Oleum, Calif	Oleum	7-40	1500	950	3	200	B	1.5	5.9	2.5	8.0	ST	30.0
Central New York Power Corp	Oswego, N. Y		7-40	1500	903	1	900	B	....	....	....	....	ST	....
†Ohio Power Co	Windsor, W. Va	Windsor	1938	1475	925	2	750	B	13.0	18.4	7.2	36.4	D,ST	28.5
†West Penn Power Co	Windsor, W. Va	Windsor	1938	....	....	....	....	....	....	....	....	....	....	....
†Public Service Electric & Gas Co	Newark, N. J	Essex	9-38	1475	950	2	605	B	3.1	15.4	6.8	27.8	ST	27.0
†Columbus Ry, Power & Lt Co	Groveport, Ohio	Walnut	1938	1475	910	2	200	....	....	....	3.3	....	D	....
†Consolidated Edison Co of N. Y	New York, N. Y	Waterside	6-38	1400	900	2	500	S	7.0	14.0	7.6	20.3	ST	30.0
†Edison Elect Illum Co	Boston, Mass	L Street	10-38	1400	910	2	375	B	4.8	7.8	5.3	16.0	D	32.0
Chicago Dist Elect Gen Corp	Hammond, Ind	State Line	12-37	1400	850	2	500	S	8.1	9.6	3.4	19.5	ST	31.0
						1	385	S	8.1	8.0	3.4	19.5	ST	31.0
†Metropolitan Edison Co	Reading, Pa	West Reading	1938	1400	900	2	275	B	5.1	7.3	5.4	15.7	D	25.4
†Philadelphia Electric Co	Philadelphia, Pa	Schuylkill	1938	1350	910	2	600	B	11.2	16.3	8.1	27.3	ST	27.3
†Narragansett Electric Co	Providence, R. I		1938	1350	925	1	430	B	....	....	....	....	D	....
800 TO 999 LB														
†Madison Gas & Electric Co	Madison, Wis	Blount St	1938	975	825	1	250	B	1.9	3.9	3.3	8.0	ST	41.3
†Potomac Edison Co	Cumberland, Md	River	1938	925	830	1	312	B	6.2	5.4	4.8	15.4	D	26.2
Toledo Edison Co	Toledo, Ohio	Acme	5-38	900	825	1	325	B	18.3	7.9	3.7	13.2	D,ST	25.6
Ohio Public Service Co	Warren, Ohio	Mahoningside	9-38	900	850	1	300	B	16.6	8.6	4.0	13.2	D,ST	28.6
†Consumers Power Co	Bay City, Mich	Weadock	1938	900	900	2	400	B	7.4	9.5	4.1	22.0	D	24.5
Houston Lighting & Pwr Co	Houston, Tex	Gable St	3-39	875	910	1	250	B	10.5	8.8	1.7	10.0	D	35.0
†New Orleans Public Service Co	New Orleans, La	Market St	1938	875	905	1	385	B	20.8	9.3	4.1	17.4	....	29.1
Albuquerque Gas & Elect Co	Albuquerque, N. Mex		1938	875	820	1	86	....	....	....	....	....	....	40.0
Virginia Elect & Power Co	Richmond, Va	Twelfth St	11-39	860	835	1	425	B	24.8	9.2	11.0	20.0	ST	28.4
†Williamsburgh Power Plant Corp	Brooklyn, N. Y	Williamsburg	7-38	850	830	2	575	S	6.9	10.8	5.5	19.9	ST	34.7
Detroit Edison Co	Detroit, Mich	Delray	6-40	815	900	....	....	....	....	....	....	....	....	....
†Central Illinois Light Co	Peoria, Ill	E. Peoria	1938	800	850	1	300	B	14.7	....	10.0	19.7	D	21.0
†Georgia Power Co	Atlanta, Ga	Atkinson	1938	800	850	2	400	....	....	....	....	....	....	....
†Consumers Power Co	Comstock, Mich	Morrow	1938	800	850	1	400	B	7.4	9.5	4.1	22.0	D	24.5
†Ohio Edison Co	Springfield, Ohio	Mad River	1938	800	850	1	225	B	6.2	7.2	4.3	....	D	29.6
†Southern Ind. Gas & Elect Co	Evansville, Ind	Ohio River	1938	800	850	1	225	B	5.3	6.8	2.5	12.3	D	25.2
†Penn Power Co	New Castle, Pa	New Castle	1938	800	850	1	400	B	7.4	9.5	4.1	....	D	24.5
500 TO 799 LB														
†Cincinnati Gas & Elect Co	Cincinnati, Ohio	Columbia	6-38	775	910	2	350	B	....	7.4	7.2	4.8	ST	51.2
Rochester Gas & Elect Co	Rochester, N. Y	Station 3	3-38	750	775	1	250	B	....	4.5	4.0	13.7	D	....
†Milwaukee Elect Ry & Light Co	Milwaukee, Wis	E Wells St	1938	725	825	1	225	B	13.5	5.6	6.0	18.0	D	16.5
Kansas Gas & Electric Co	Ripley, Kan	Ripley	7-38	725	835	2	160	B	10.7	3.4	2.1	6.1	D	34.0
†Hawaiian Electric Co	Honolulu, T. H	Pearl Harbor	1938	700	825	1	90	....	9.0	....	....	4.5	D	33.5
†Indianapolis Pwr & Lt Co	Indianapolis, Ind		1938	683	786	2	350	B	20.1	7.5	1.0	19.6	D	21.7
†Dallas Power & Light Co	Dallas, Tex	Mtn Creek	1938	675	830	2	200	B	13.8	2.4	....	7.1	....	36.0
Kansas Electric Power Co	Lawrence, Kan	Lawrence	1-39	668	850	2	60	B	5.2	1.5	1.5	3.3	....	25.4
Gulf States Utilities Corp	Baton Rouge, La	Louisiana	12-38	650	750	2	500	B	28.7	7.9	3.8	22.0	D	28.0
Detroit Edison Co	Detroit, Mich	Conners Creek	10-39	600	850	....	....	....	....	....	....	....	....	....
Fort Dodge Gas & Elect Co	Fort Dodge, Iowa		.....	500	740	1	60	B	6.2	0.5	....	4.1	D	34.8
400 TO 499 LB														
†Nebraska Power Co	Omaha, Neb	S Omaha	1938	475	775	2	200	B	11.8	3.2	3.3	6.8	....	36.9
†Pacific Gas & Electric Co	Oakland, Calif	Station C	1938	475	725	2	220	B	17.6	....	....	8.2	D	34.0
†Duquesne Light Co	Pittsburgh, Pa	Reed	1938	475	760	2	350	B	30.6	9.8	3.3	15.4	....	32.0
†Northern States Power Co	Minneapolis, Minn	Riverside	1938	450	750	2	275	S	3.8	1.6	11.0	....	....	33.8
Virginia Electric & Power Co	Norfolk, Va	Reeves Ave	5-38	450	750	1	240	S	17.8	3.6	1.4	7.1	....	47.5
Portland General Electric Co	Portland, Ore	L Station	9-37	450	725	1	225	B	12.8	2.8	2.9	7.4	....	40.0
Porto Rico Ry & Light Co	Porto Rico	Santurce	1-39	440	710	1	75	B	6.7	....	....	3.4	D	39.4
†Public Service Co of Colo	Denver, Colo	Valmont	1938	425	750	1	225	B	17.7	....	3.7	12.3	D,ST	25.2
Public Service of Colo	Alamosa, Colo	Alamosa	1939	425	760	1	60	....	....	....	....	....	....	33.3
Central Kansas Pwr & Lt Co	Hays, Kan	Hays	3-38	400	700	....	....	....	....	....	....	....	....	....
Northern States Pwr Co	Minot, N. D		.....	400	750	....	....	....	....	....	....	....	....	....
Central Arizona Lt & Pwr Co	Phoenix, Ariz	Central Ariz	1938	400	750	1	165	....	....	....	....	....	....	35.7
BELOW 400 LB														
Arkansas Pwr & Light Co	Little Rock, Ark	Little Rock	.....	300	617	1	188	B	18.3	....	....	9.1	....	21.2
Southwestern Electric Co	Tuco, Texas	Tuco	1939	300	700	1	57	B	....	....	....	....	....	33.8
San Diego Gas & Elect Co	San Diego, Calif	Station B	3-38	275	740	2	200	B	17.3	3.0	2.4	8.2	....	32.1
St Joseph Lt, Heat & Pwr Co	St Joseph, Mo	So. St Joseph	11-38	200*	530	1	130	B	....	....	....	5.1	....	33.6
N. Dakota Pwr & Lt Co	Bismarck, N. D		.....	175**	475	2	30.0	B	4.0	0.1	0.2	1.5	....	34.0
MUNICIPALS														
†Board of Water & Elect Lt Comm	Lansing, Mich	Ottawa St	1938	925	200	2	225	S	2.8	7.0	3.2	8.2	ST	32.2
†Dept of Water, Lt & Power	Kansas City, Kan	Quindaro	1938	450	750	1	180	B	16.3	....	1.9	11.2	ST	22.4
Boro of Lansdale	Pennsylvania		1-39	450	625	1	80	B	7.3	....	1.7	4.1	D	25.0
†Municipal Lt & Pwr Plant	Ames, Iowa		1938	450	750	2	40	B	3.8	1.0	0.3	....	....	40.4
City of Richmond	Indiana		12-38	450	725	1	100	B	10.1	3.2	0.8	5.2	....	26.3
Town of Braintree	E Braintree, Mass		1939	450	640	1	90	B	....	....	....	....	....	33.8
Fairbury Light & Water Dept	Fairbury, Neb		11-38	425	750	1	35	B	3.9	0.7	1.2	2.4	D	....
Water & Electric Dept	McPherson, Kan		6-38	425	700	1	50	B	6.0	1.3	0.8	3.4	D	25.0
City of Jacksonville	Florida		2-39	415	725	1	250	S	15.4	....	1.4	9.1	D	28.8
Napoleon Waterworks & Lt Plant	Napoleon, Ohio		3-39	385	700	1	36	B	4.6	1.0	....	....	....	....
City of Yazoo City	Mississippi		7-38	250	615	1	60	B	8.2	....	0.4	3.6	....	24.2
City of Princeton	Illinois		12-38	250	560	1	30	S	3.1	1.1	....	....	....	....
City of Richland Center	Wisconsin		1-39	225	497	....	....	....	....	....	....	....	....	....
City of Henderson	Kentucky		.....	200	500	1	60	B	....	....	....	....	....	....
City of Thomasville	Georgia		6-38	200	500	....	....	....	....	....	....	....	....	....
City of Jasper	Indiana		1-38	190	459	....	....	....	....	....	....	....	....	....
City of Reading	Ohio		1-39	.....	.....	....	....	....	....	....	....	....	....	....
Water & Light Dept	Willmar, Minn		11-38	.....	.....	....	....	....	....	....	....	....	....	....

A —Air cooling
B —Bent tube
BT —Backpressure turbine
BET —Backpressure-extraction turbine
BFG —Blast-furnace gas
C —Cyclone
CT —Condensing turbine
CET —Condensing-extraction turbine
CG —Coke gas
D —Dry bottom
DD —Dual drive
EP —Electrostatic precipitator
F —Cinder-eliminator fan
G —Gas
H —Hydrogen cooling
M —Motor drive

Installed or Under Construction Since Sept, 1937

Economizer Surface per Boiler, 1000 Sq Ft	Air-Heater Surface per Boiler, 1000 Sq Ft	FORCED DRAFT			INDUCED DRAFT			Firing	FUEL		Flyash Removal	FEED PUMPS			TURBINES						Condenser Surface, 1000 Sq Ft	Generator Cooling, Air or Hydrogen
		Number per Boiler	Capacity Each, 1000 CFM,	Drive	Number per Boiler	Capacity Each, 1000 CFM	Drive		Heating Value, 1000 BTU per Lb	Ash Fusion Temp, F		Number	Capacity, Each, GPM	Drive	Type	Speed, RPM	Capacity, 1000 KW	Backpressure, Lb/Abs	No. of Bleed Points	Bleed Press., Lb/Abs		
....	....	2	....	M	2	....	M	PC	10.1	.....	....	3	....	.....	BET	3600	22.5	375	1	650	....	H
															CET	1800	45.0	0.5	4	190-9	31.5	A
5.1	12.5	1	67	M	1	134	M	Oil	18.5	.....	....	3	550	DD	CET	3600	40.0	1.0	3	240	19.4	H
5.1	12.5	1	67	M	1	134	M	Gas	1.2	.....	....	3	550	DD	CET	3600	40.0	1.0	3	240	19.4	H
5.1	12.5	1	67	M	1	134	M	Pet C	14.5	.....	....	3	550	DD	CET	3600	40.0	1.0	3	240	19.2	H
....	....	2	....	M	2	....	M	PC	14.5	2550	....	3	....	M	CET	1800	80.0	0.5	6	.....	....	H
11.0	47.8	2	114	M	2	237	T	PC	12.5	2300	....	4	....	.....	BT	3600	60.0	250	....	.....	....	H
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	BT	3600	60.0	250	....	.....	....	H
16.3	73.6	1	185	M	1	320	M	PC	14.1	2340	EP	6	1360	.....	BT	3600	50.0	225	....	.....	....	H
....	....	1	79	M	1	106	M	PC	11.6	2380	....	3	550	.....	CT	3600	30.0	0.7	....	.....	....	H
18.9	32.7	2	87	M	2	139	M	PC	14.2	2570	EP	3	1250	M	CET	3600	53.0	215	2	100-20	....	H
11.9	47.0	1	120	M	1	200	M	PC	14.9	2600	EP	4	870	.....	.....	3600	25.0	....	....	.....	....	A
31.2	79.8	2	72.5	M	2	115	M	PC	10.0	1900	....	1‡	3000	M	CET	1800	150.0	0.5	4	410-7	90.0	H
14.7	79.8											2	1500	T								
8.4	40.4	2	55	M	2	93	M	PC	13.8	2630	EP	3	680	.....	BT	3600	20.0	265	....	.....	....	A
11.5	55.0	2	103	M	2	188	M	PC	14.2	2500	EP	3	1700	.....	BT	3600	50.0	245	....	.....	....	H
....	....	2	....	M	2	....	M	PC	.....	.....	....	2	....	.....	CET	3600	40.0	....	4	.....	....	H
6.7	13.9	1	86	M	1	141	M	PC	11.6	1920	....	....	....	.....	CET	3600	20.0	0.5	5	291-21	12.6	A
7.7	31.6	2	49	M	2	93	M	PC	14.0	2800	EP	3	730	.....	CET	3600	30.0	0.7	4	196-10	25.0	A
....	37.6	1	68	M	1	100	M	PC	12.0	2000	F	2	600	DD, T	BT	3600	5.0	235	....	.....	....	A
....	37.6	1	69	M	1	160	M	PC	12.7	2100	....	2	650	DD, T	BT	3600	6.0	215	....	.....	....	A
28.5	54.1	1	130	M	1	215	M	PC	13.5	2500	F	3	1000	.....	CET	3600	35.0	0.6	4	137-7	33.0	H
															CET	3600	35.0	0.6	4	137-7	33.0	H
6.2	39.0	1	73	M	1	115	M	Gas-Oil	.....	.....	....	2	650	MT	CET	3600	25.0	1.0	3	140	24.0	A
4.0	39.2	2	60	M	2	97	M	PC-G-O	.....	.....	....	3	395	.....	CET	3600	37.5	0.7	4	213-15	36.9	H
....	....	....	....	....	....	....	....	Gas	.....	.....	....	....	....	.....	.....	.....	....	....	....	.....	....	....
....	32.2	2	78	M	2	155	M	PC	14.3	2300	EP	2	700	M	CET	3600	40.0	0.7	3	184-13	27.5	H
36.9	49.0	1	178	M	1	262	M	PC	14.0	2700	EP	3	1435	T	BT	1500	18.8	225	....	.....	....	A
															BT	1500	18.8	225	....	.....	....	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	1800	75.0	0.5	4	211-7	53.6	A
5.8	43.5	1	100	M	1	170	M	PC	9.8	2000	....	2	755	.....	CET	3600	25.0	0.6	4	133-9	21.4	A
....	....	1	....	....	1	....	....	PC	.....	.....	....	2	....	.....	CT	3600	35.0	0.5	....	.....	38.0	H
															CT	3600	35.0	0.5	....	.....	38.0	H
28.5	54.1	1	130	M	1	215	M	PC	13.5	2500	F	2	1000	.....	CET	3600	35.0	0.6	4	137-7	33.0	H
14.1	22.5	1	75	M	1	125	M	PC	13.3	2500	F	2	575	.....	CET	3600	20.0	0.6	4	104-5	18.2	A
14.6	26.1	1	75	M	1	125	M	PC	11.0	2100	F	2	575	.....	CET	3600	20.0	0.6	4	123-6	18.3	A
28.5	54.1	1	130	M	1	215	M	PC	13.5	2500	F	2	1000	.....	CET	3600	35.0	0.6	4	130-7	33.0	H
15.0	34.8	1	112	M	1	180	M	PC	13.7	2650	....	3	700	.....	CET	1800	65.0	0.5	4	250-22	51.8	H
20.8	....	1	69	M	1	107	M	PC	13.5	.....	EP	2	618	DD, T	.....	.....	....	....	....	.....	....	....
....	52.3	2	37	M	2	57	M	PC	12.8	2250	....	2	490	.....	BET	3600	13.7	35.0	2	150-75	2.2	H
....	11.4	1	49	M	1	90	M	Gas-Oil	.....	.....	....	3	430	2 M, T	CET	3600	20.0	1.0	3	185	29.2	A
....	....	1	25	M	1	45	M	Oil	18.6	.....	....	2	200	.....	CET	3600	7.5	0.8	3	182-1	8.2	A
....	....	1	112	....	1	217	T	PC	10.5	1900	EP	....	....	.....	BT	.....	12.5	260	....	.....	....	....
1.5	19.6	1	63	M	1	98	M	Gas-Oil	.....	.....	....	3	420	.....	CET	1800	35.7	0.8	3	193-7	27.1	A
....	6.8	1	19	M	1	33	M	Gas	1.0	.....	....	3	290	2 M, T	CT	3600	10.0	0.5	....	.....	10.0	A
....	48.8	2	80	T	2	125	T	Gas	1.0	.....	....	1	1500	T	CET	3600	15.0	2.0	2	155-20	11.7	A
															CET	3600	15.0	2.0	2	155-20	11.7	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	1800	60.0	0.5	3	165-9	37.0	A
....	5.1	1	116	M	1	146	M	PC-G-O	10.0	.....	....	2	250	M	.....	.....	....	....	....	.....	....	....
....	20.0	1	63	M	1	104	M	Oil-Gas	.....	.....	....	3	600	.....	BET	3600	5.0	45	1	190	....	A
....	15.1	1	70	M	1	140	M	Oil-Gas	18.5	.....	....	2	600	.....	CET	1800	40.0	0.8	3	144-7	30.0	A
8.5	27.8	2	69	M	2	105	M	St	13.2	2100	....	1	1800	.....	CET	1800	60.0	0.8	3	.....	55.0	H
12.7	....	1	100	M	2	150	M	St	13.5	2150	....	1	1000	.....	CET	1800	35.0	0.5	3	80-22	24.4	A
												1	500	.....								
4.4	....	2	50	M	2	75	M	St (474)	14.2	2725	....	....	....	.....	.....	.....	....	....	....	.....	....	....
....	25.5	1	57	M	1	125	M	Oil	18.5	.....	....	....	....	.....	.....	.....	....	....	....	.....	....	....
....	....	1	33	M	1	58	M	Oil	18.2	.....	....	....	....	.....	CET	3600	5.0	1.2	2	134-26	5.7	A
....	49.0	1	96	M	1	....	M	PC	9.5	2090	....	1	1250	.....	CET	3600	25.0	0.5	5	114-25	30.0	A
....	....	....	....	....	....	....	....	PC	.....	.....	....	....	....	.....	CT	3600	3.0	....	....	.....	....	....
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	3600	3.5	0.5	3	134-19	5.3	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CT	3600	5.0	1.0	....	.....	....	A
....	....	....	....	....	....	....	....	Gas-Oil	.....	.....	....	....	....	.....	.....	.....	....	....	....	.....	....	....
....	....	1	61	M	1	142	T	Gas-Oil	.....	.....	....	2	450	T	CT	1800	10.0	1.0	....	.....	17.2	A
....	....	....	....	....	....	....	....	Oil-Gas	.....	.....	....	....	....	.....	CT	3600	7.5	1.2	....	.....	11.0	A
....	15.5	1	58	M	1	104	M	Oil-Gas	.....	.....	....	1	1060	M	CET	1800	35.0	1.2	3	132-9	38.4	A
....	....	....	....	....	....	....	T	Gas	1.0	.....	....	3	....	SD	.....	.....	....	....	....	.....	....	....
....	3.3	1	45	M	1	56	M	St (130)	7.0	2300	....	1	175	M	.....	.....	....	....	....	.....	....	....
6.8	42.8	2	35	M	2	115	M	PC	13.2	2450	EP	4	300	.....	CET	3600	25.0	0.5	6	536-23	23.0	H
															BT	3600	4.0	224	....	.....	....	A
															BT	3600	2.5	15	....	.....	....	A
1.8	19.6	1	68	M	1	109	M	PC	12.0	.....	....	2	800	.....	CET	1800	30.0	0.8	3	.....	40.0	A
....	9.4	1	27	M	1	48	M	PC	14.0	2450	C	....	....	.....	.....	.....	....	....	....	.....	....	....
3.8	....	1	18	M	1	22	M	St	9.2	1950	....	....	....	.....	.....	.....	....	....	....	.....	....	....
3.4	....	1	54	M	1	68	M	St (263)	11.3	2050	....	....	....	.....	.....	.....	....	....	....	.....	....	....
....	....	....	....	....	....	....	....	Oil	.....	.....	....	....	....	.....	.....	.....	....	....	....	.....	....	....
....	3.5	1	....	M	1	....	M	PC-G-O	.....	.....	....	2	80	MT	CT	3600	2.5	1.0	2	.....	3.8	A
....	....	1	21	M	1	46	M	Gas	11.2	.....	....	1	140	M	.....	.....	....	....	....	.....	....	....
....	25.8	2	20	M	2	36	M	Oil	18.9	.....	....	....	....	.....	CET	3600	37.5	0.5	6	329-12	46.0	A
....	....	1	18	DD	....	....	....	St (90)	.....	.....	....	2	175	DD	.....	.....	....	....	....	.....	....	....
....	....	....	....	....	1	70	T	Gas	1.0	.....	....	1	160	T	.....	.....	....	....	....	.....	....	....
....	....	1	13	M	....	....	....	St (80)	11.0	2050	....	1	80	SD	CET	3600	1.3	1.0	2	18-	1.3	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	3600	1.5	1.0	3	10	2.2	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	1	200	T	.....	.....	....	....	....	.....	....	....
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	3600	2.5	1.2	1	17	3.5	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	1	100	T	CT	3600	2.0	1.0	....	.....	4.4	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	3600	1.0	1.2	2	5	....	A
....	....	....	....	....	....	....	....	.....	.....	.....	....	....	....	.....	CET	3600	1.0	2.0	1	20	....	A

MPT—Mixed-pressure turbine
MT—One motor, one turbine drive
O—Oil
PC—Pulverized coal
Pet C—Petroleum coke
S—Straight tube
SE—Steam engine
SD—Steam drive
ST—Slag tap
St—Stoker
T—Turbine
*—To operate at 900 lb ultimately
†—Listed Mid-Sept, 1937 as on order or under construction
**—To operate at 450 lb, 750 F ultimately
‡—Reciprocating pump

Industrial and Other Steam Plants Installed

Compiled by S A Tucker, *Associate Editor*

Company	Location	First Operation, New Units	Pressure, Lb	BOILERS						FURNACES			
				Steam Temp, F	Number	Capacity Each, 1000 Lb per Hr	Straight - or Bent - Tube	Boiler Surface, 1000 Sq Ft	Superheater Surface 1000 Sq Ft	Waterwall Surface 1000 Sq Ft	Volume, 1000 Cu Ft	Bottom	Heat Liberation, 1000 Btu per Cu Ft
700 LB AND ABOVE													
Masonite Corp	Laurel, Miss	12-37	1200	567	1	60	S	5.3	....	....	3.1	..	24.0
RCA Mfg Co	Camden, N. J	1-38	900	750	2	125	B	4.9	2.7	3.0	6.8	D	25.0
Kimberly-Clark Corp	Kimberly, Wis	5-38	900	750	1	170	B	14.4	....	2.1	6.8	D	34.1
Simpson Logging Co	Shelton, Wash	4-39	850	800	1	120	B	11.9	....	....	....	..	31.0
Western Cartridge Co	E. Alton, Ill	1-39	725	750	2	75	B	5.9	1.0	2.3	3.9	D	23.7
†Industrial Rayon Corp	Painesville, Chio	10-38	725	780	3	90	B	8.7	....	1.9	....	D	....
General Electric Co	Pittsfield, Mass	11-38	700	825	2	100	B	9.9	1.8	1.4	4.8	D	26.0
600 TO 699 LB													
Bathurst Pwr & Paper Co	Bathurst, N. B	10-37	675	725	1	110	B	9.3	....	2.2	7.2	D	16.5
Container Corp of America	Fernandina, Fla	12-37	650	750	1	76	B	8.9	....	....	....	..	....
Scott Paper Co	Chester, Pa	1-39	650	750	1	125	B	11.4	2.3	1.6	5.6	..	....
Continental-Diamond Fibre Co	Newark, Del	6-38	650	625	1	45	B	....	....	1.4	2.5	D	24.4
Northern Paper Mills	Green Bay, Wis	11-38	650	700	2	75	B	7.0	1.0	2.1	3.6	D	23.5
Winchester Repeating Arms Co	New Haven, Conn	7-38	650	750	2	75	B	5.9	....	2.0	3.9	D	23.5
Firth Sterling Steel Co	McKeesport, Pa	3-38	650	620	1	55	B	6.7	....	....	....	D	27.9
†Port Huron Sulphite & Paper Co	Port Huron, Mich	6-38	610	710	1	90	B	7.9	....	1.9	4.5	D	24.7
Glen Alden Coal Co	Ashley, Pa	2-39	600	635	4	40	B	6.2	0.9	0.1	2.4	..	41.9
Rayonier	Fernandina, Fla	.....	600	750	2	90	B	11.6	....	....	....	..	....
400 TO 599 LB													
E I du Pont de Nemours	Old Hickory, Tenn	1-39	550	700	1	140	B	13.3	4.4	3.4	13.0	D	14.0
Penick Ford Co	Cedar Rapids, Iowa	3-38	500	586	1	100	B	9.5	....	0.3	....	D	18.1
Wilshire Oil Co	Norwalk, Calif	8-38	500	570	1	50	B	4.3	....	....	....	..	38.2
Procter & Gamble Co	Staten Island, N. Y	.....	500	600	1	160	B	14.4	0.2	0.8	7.4	D	29.5
General Electric Co	Bridgeport, Conn	11-38	475	750	2	100	B	8.8	1.6	1.6	4.5	D	28.3
Great Lakes Steel Corp	Detroit, Mich	10-38	450	700	2	75	B	9.8	1.1	1.2	5.5	..	....
J L Stifel & Sons	Wheeling, W. Va	1-38	450	403	1	110	B	....	....	....	....	D	....
American Viscose Corp	Front Royal, Va	2-39	450	700	3	225	B	125	....	3.6	10.2	D	22.5
Oscar Mayer & Co	Madison, Wis	1-39	450	670	1	75	B	....	....	....	....	..	....
Hellwig Silk Dyeing Co	Philadelphia, Pa	4-38	450	625	1	105	B	14.0	....	2.2	5.4	D	25.0
Oneida, Ltd	Oneida, N. Y	8-38	450	368	1	50	B	5.4	....	....	2.1	D	32.9
Holliston Mills	Norwood, Mass	5-38	450	585	1	20	B	3.4	....	....	1.5	..	....
Southern Alkali Corp	Corpus Christi, Tex	3-38	*425	750	1	150	B	11.2	....	....	4.8	..	....
Mead Corp	Kingsport, Tenn	9-38	400	650	3	75	B	8.0	....	....	3.2	D	30.0
Dow Chemical Co	Midland, Mich	11-38	400	700	..	....	....	....	....	....	....	..	....
200 TO 399 LB													
American Enka Corp	Enka, N. C	1939	365	700	1	75	B	8.2	....	....	4.2	D	22.5
Hartford City Paper Co	Hartford City, Ind	4-38	350	600	1	55	B	6.7	....	1.3	3.4	D	....
Heywood-Wakefield Co	Gardner, Mass	6-38	300	617	2	60	B	6.2	....	....	2.2	D	15.0
Acadia Sugar Refining Co	Dartmouth, N. S	11-37	300	600	1	90	B	8.5	1.0	1.9	4.1	D	29.0
R J Reynolds Tobacco Co	Winston-Salem, N. C	10-37	275	414	1	24	B	3.5	....	....	....	..	....
Winslow Bros & Smith Co	Norwood, Mass	12-37	250	500	1	50	B	5.7	....	....	1.9	D	37.0
Natural Products Ref Co	Jersey City, N. J	7-37	250	....	1	36	B	4.4	....	....	1.7	..	25.2
Hercules Powder Co	Kenvil, N. J	11-38	250	565	..	....	..	....	....	....	....	..	....
Norfolk & Western R R Co	Roanoke, Va	.....	250	478	2	25	B	3.2	....	....	1.1	D	35.0
Weir Kilby Corp	Norwood, Ohio	8-38	250	400	1	30	B	....	....	....	....	..	....
American Potash & Chem Corp	Trona, Calif	2-38	245	580	1	217	B	16.3	....	1.1	7.0	..	34.5
Quaker Oats Co	Akron, Ohio	7-38	225	500	2	38	B	5.2	0.5	0.5	1.4	..	37.6
Skelly Oil Co	Eldorado, Kan	5-38	200	500	1	65	B	10.4	....	....	8.0	..	....
American Snuff Co	Memphis, Tenn	10-38	200	480	1	41	S	4.7	....	....	....	..	....
Singer Mfg Co	Bridgeport, Conn	12-38	200	474	2	35	B	4.4	....	....	1.7	..	27.7
Mica Insulator Co	Schenectady, N. Y	10-38	200	510	1	35	B	3.3	....	....	1.1	D	37.0
American Optical Co	Southbridge, Mass	7-38	200	468	..	....	..	....	....	....	....	..	....
Electric Auto-lite Co	Bay City, Mich	2-38	200	....	1	33	..	....	....	....	....	..	....
BELOW 200 LB													
Glidden Co	Chicago, Ill	6-38	180	470	1	57	B	5.0	....	0.5	2.6	..	28.6
McDowell Paper Mills	Philadelphia, Pa	.....	175	377	1	60	S	6.7	....	0.2	3.1	..	....
Allis-Chalmers Mfg Co	W. Allis, Wis	9-38	175	452	2	150	B	12.1	0.6	4.3	9.6	D	20.0
Pratt, Read & Co	Ivoryton, Conn	12-38	160	470	1	23	B	2.0	0.1	0.5	0.8	..	35.2
Kendall Refining Co	Bradford, Pa	11-37	*155	550	1	70	B	6.3	0.8	1.5	3.6	D	17.7
Republic Rubber Co	Youngstown, Ohio	11-38	*150	....	1	70	B	7.5	....	0.4	3.0	..	30.0
Pure Oil Co	Toledo, Ohio	11-38	150	470	1	65	B	5.3	0.4	1.7	2.3	..	40.0
Pittsburgh & Lake Erie R R	Pittsburgh, Pa	1-39	140	361	3	27	B	4.0	....	....	....	..	....
Stonecutter Mills Co	Spindale, N. C	11-37	*125	....	1	40	B	5.0	....	....	....	..	....
GOVERNMENT & INSTITUTIONAL													
Puget Sound Navy Yard	Bremerton, Wash	6-39	425	700	1	125	B	....	....	....	....	..	30.0
University of Missouri	Columbia, Mo	12-38	275	600	1	50	S	5.0	1.3	0.4	1.6	..	44.7
Polk State School	Polk, Pa	.....	200	....	3	....	S	5.5	....	....	....	..	....
U. S. Marine Corps	Quantico, Va	12-38	200	....	2	50	B	6.0	....	1.7	2.7	D	30.0
State College of Wash	Pullman, Wash	4-38	200	388	1	58	S	5.0	....	0.1	2.0	..	35.4
Lenox Hill Hosp	New York, N. Y	9-38	200	371	2	27	B	2.9	....	0.3	0.9	..	....
Norristown State Hosp	Norristown, Pa	11-38	175	486	2	50	B	8.0	....	....	1.9	..	34.5
Stevens Trade School	Lancaster, Pa	11-38	165	....	1	....	S	1.5	....	....	....	..	....
Broadmoor Hotel	Colorado Springs, Colo	7-38	150	470	1	26	..	2.7	....	1.3	1.7	..	22.0
Nassau Hospital	Mineola, N. Y	10-38	125	....	2	....	S	....	....	....	....	..	....
Baroness Erlanger Hosp	Chattanooga, Tenn	10-38	125	....	2	50	B	3.6	....	....	....	..	....
Springfield State Hosp	Sykesville, Md	11-38	....	....	..	....	..	....	....	....	....	..	....
Binghamton State Hosp	Binghamton, N. Y	11-38	....	....	..	....	..	....	....	....	....	..	....
Pennsylvania State College	State College, Pa	12-38	....	....	..	....	..	....	....	....	....	..	....
Northern State Hosp	Sedro Woolley, Wash	6-38	....	....	..	....	..	....	....	....	....	..	....
Picatinny Arsenal	Dover, N. J	9-38	....	....	..	....	..	....	....	....	....	..	....
University of Colorado	Denver, Colo	4-38	....	....	1	....	B	....	....	....	1.1	..	38.0

*— Boiler designed for future high-pressure operation.

†— Listed Mid-September, 1937 as on order or under construction.

or Under Construction Since Sept, 1937

Economizer Surf per Boiler, 1000 Sq Ft	Air Heater Surf per Boiler, 1000 Sq Ft	FORCED DRAFT			INDUCED DRAFT			Firing	FUEL		Flyash Removal	FEED PUMPS			TURBINES						Condenser Surf 1000 Sq Ft
		Number per Boiler	Capacity Each, 1000 CFM	Drive	Number per Boiler	Capacity Each, 1000 CFM	Drive		Heating Value, 1000 Btu per Lb	Ash Fusion Temp, F		Number	Capacity Each, GPM	Drive	Type	Speed, RPM	Capacity, 1000 Kw	Backpressure, Lb Abs	No. of Bleed Points	Bleed Press., Lb Abs	
2.4	..	..	..	..	1	34	M	Gas	1.0	....	..	2	60	SD	....	....	..	..	..	....	....
..	13.0	1	45	M	1	90	M	PC	14.3	2700	C	3	300	2T 1M	CET CET	3600 3600	3.5 3.5	1.0 1.0	2 2	190–35 190–35	3.7 3.7
..	12.7	1	..	M	1	..	T	PC	13.6	2400	..	....	....	....	....	....	..	..	..	....	....
..	13.2	1	32	M	1	105	M	Wood	4.5	....	..	2	300	T	BT	3600	3.0	175.0	..	....	....
..	8.8	1	20	M	1	37	M	PC	10.8	2048	F	2	300	MT	BET BET CET MPT	3600 3600 3600 3600	3.5 3.5 1.0 1.0	20.0 20.0 1.5 1.5	2 2 1 1	150–50 150–50 20 20	.... 4.0 4.0
..	10.6	1	28	DD	1	51	DD	PC	12.3	2200	..	....	....	....	3-CET	3600	5.0	1.0	1	15	2.8
..	12.1	1	45	M	1	74	M	PC-Oil	14.6	2500	EP	3	500	M,SD	CET	3600	7.5	0.5	2	205–17	8.0
..	9.4	1	35	M	1	72	M	PC	13.0	2000	..	2	324	M	CET	....	6.0	1.2	2	190–55	6.0
..	3.4	1	..	M	1	..	M	Oil-Bark	....	....	..	2	300	MT	CET	3600	3.0	0.7	1	65	....
..	8.7	1	45	M	1	85	M	Oil	....	....	..	1	350	T	CET	3600	5.0	0.7	2	80–32	4.1
..	2.4	1	15	M	1	30	M	PC-Oil	13.7	2300	..	2	100	T	BT	3600	0.5	115.0	..	....	....
..	6.3	1	27	M	1	48	M	PC	13.9	2400	..	2	400	M,SD	CET CET	3600 3600	2.0 3.0	0.5 0.5	1 1	150 150	2.6
..	8.8	1	..	M	1	..	M	PC	14.5	2800	F	2	300	MT	BET BET	3600 3600	3.5 3.5	20.0 20.0	2 2	165–65 165–65	....
..	5.0	1	19	M	1	39	M	PC-G	13.4	2500	..	2	300	M,SD	....	....	..	..	..	....	....
..	14.0	1	26	M	1	50	M	PC	14.0	2700	..	2	240	MT	BET	3600	2.0	45.0	1	175	....
..	..	1	30	M	..	..	..	St (199)	11.5	....	..	2	350	MT	CET	3600	7.5	1.2	2	165–37	6.5
..	10.6	1	31	M	1	75	M	Oil-Bark	18.0	....	..	2	600	MT	CET BET	3600 3600	2.5 5.0	0.7 50.0	1 1	50 150	....
..	32.1	1	54	T	1	106	T	PC	11.0	1950	..	1	625	T	BT	3600	3.0	190.0	..	....	....
..	13.3	1	43	T	1	70	T	PC-Gas	10.0	1900	..	2	700	T	....	....	..	..	..	....	....
..	4.0	1	14	T	1	27	T	Oil-Gas	....	....	..	1	300	M	....	....	..	..	..	....	....
..	16.5	1	43	M	1	100	M	PC-Oil	....	2450	..	3	....	T	....	....	..	..	..	....	....
..	10.7	1	31	M	1	58	M	PC	14.6	2500	EP	3	2–300 1–600	M T	CET CET	3600 3600	7.5 7.5	1.0 1.0	2 2	140–33 140–33	7.7
1.9	8.0	1	31	T	1	42	T	CG BFG	0.5 0.1	....	..	1	350	M	....	....	..	..	..	....	....
..	..	1	..	T	..	..	..	PC	13.4	....	..	2	250	T	BT	3600	0.8	30.0	..	....	....
..	19.0	1	70	M	1	135	M	PC	15.0	2400	C	4	500	3T 1M	CET CET CET CET CET	3600 3600 3600 3600 3600	7.5 7.5 3.0 3.0 3.0	1.0 1.0 1.0 1.0 1.0	1 1 1 1 1	40 40 40 40 40	13.3 13.3 5.7 5.7 5.7
..	..	1	..	M	1	..	M	St	....	....	..	1	200	T	....	....	..	..	..	....	....
..	..	1	..	M	..	..	..	PC-Oil	13.8	2300	..	3	300	SD	....	....	..	..	..	....	....
..	..	1	20	T	..	..	..	PC-Gas	14.1	2600	..	....	....	....	....	....	..	..	..	....	....
..	..	..	..	..	..	..	..	Oil	....	....	..	2	....	SD	BET	4500	0.4	20.0	1	160	....
..	12.3	1	..	M	1	..	M	Gas	....	....	..	1	600	T	CET	3600	5.0	1.0	1	15	9.0
..	7.9	1	26	M	1	52	T	PC	14.4	2600	..	2	750	T	BET CET	3600 3600	4.0 2.0	30.0 1.5	1 1	150 30	....
..	..	..	..	..	..	..	..	.....	....	....	..	....	....	....	BET	3600	4.0	25.0	2	140–55	....
..	8.0	1	..	T	1	..	T	PC	14.2	2600	..	4	....	MT	BET BET	3600 4500	0.8 1.0	20.0 20.0	1 1	165 165	....
..	..	1	14	T	..	..	..	PC-Oil	11.0	2100	..	2	200	T	BT	3800	0.4	110.0	..	....	....
..	..	2	..	M	..	..	..	PC Wood	14.5 8.5	2500	..	2	120	MT	CET CET	6060 7160	0.8 0.2	1.5 1.5	1 1	25 25	0.7 0.7
..	..	1	22	T	..	..	..	PC-Oil	12.5	....	..	....	....	....	....	....	..	..	..	....	....
..	..	1	10	T	..	..	..	St (78.2)	13.5	2400	..	2	120	SD,M	....	....	..	..	..	....	....
..	..	1	21	M	..	..	..	PC	14.5	2350	..	....	....	....	....	....	..	..	..	....	....
..	1.8	1	8	M	1	14	M	Oil	18.0	....	..	2	100	SD	....	....	..	..	..	....	....
..	..	..	..	..	..	..	..	.....	....	....	..	....	....	....	CET	3600	1.0	1.0	1	65	....
..	..	1	25	M	..	..	..	PC	14.0	2300	..	2	120	SD	....	....	..	..	..	....	....
..	..	1	10	SD	..	..	..	St (70)	....	....	..	2	400	SD	....	....	..	..	..	....	....
3.2	17.5	1	55	M	1	70	M	Oil	....	....	..	....	....	....	BT	3600	6.0	33.0	..	....	....
..	..	1	13	M	..	..	..	St (124)	12.3	2000	..	1	167	M	....	....	..	..	..	....	....
..	..	..	..	..	..	..	..	Oil Gas	18.0 1.1	....	..	....	....	....	....	....	..	..	..	....	....
..	..	1	15	T	..	..	..	St (145)	....	....	..	....	....	....	....	....	..	..	..	....	....
..	..	1	..	M	1	..	M	Oil	18.5	....	..	....	....	....	....	....	..	..	..	....	....
..	1.9	1	..	M	1	..	M	PC	14.2	2300	..	2	....	....	....	....	..	..	..	....	....
..	..	..	..	..	..	..	..	.....	....	....	..	1	175	M	CET	3600	3.0	1.0	2	65–18	....
..	..	1	..	M	..	..	..	.....	....	....	..	....	....	....	....	....	..	..	..	....	....
..	..	1	..	M	1	..	T	St (120)	11.8	2200	..	2	210	MT	....	....	..	..	..	....	....
..	..	1	23	M	..	..	..	Oil	18.5	....	..	2	265	SD	CT	3600	0.5	1.0	..	....	2.0
..	13.5	1	41	M	1	67	M	PC	12.4	....	C	2	850	MT	....	....	..	..	..	....	....
0.6	..	1	10	T	..	..	..	Wood St (55)	7.5 14.0	....	..	1	60	SD	....	....	..	..	..	....	....
..	5.4	1	20	M	1	47	M	Gas PC-Oil	1.2 13.5	 2100	..	2	175	SD,M	....	....	..	..	..	....	....
2.4	..	1	92	T	1	113	T	St (170)	13.2	2200	..	....	....	....	....	....	..	..	..	....	....
..	5.3	1	22	DD	1	50	T	Gas Oil	1.5 18.9	....	..	2	300	MT	....	....	..	..	..	....	....
..	..	1	15	T	..	..	..	St (92.8)	13.5	2200	..	2	170	T	CT	3600	0.8	1.0	..	....	1.1
..	..	1	18	M	1	35	T	St (105)	14.0	2700	..	1	80	M	....	....	..	..	..	....	....
..	..	1	37	M	1	75	M	Oil	18.6	....	..	2	260	MT	CET	3600	6.0	1.0	2	165–10	3.9
..	2.1	1	14	M	1	32	M	St (143)	11.1	2275	..	2	300	MT	BT	3600	0.8	45.0	..	....	....
..	..	1	12	M	..	..	..	St (100)	13.0	2500	..	3	....	SD,M	....	....	..	..	..	....	....
..	3.7	1	15	DD	1	25	DD	PC	14.7	2800	..	....	....	....	....	....	..	..	..	....	....
1.9	..	1	26	SE	1	43	SE	St (117)	12.5	2700	..	1	125	T	....	....	..	..	..	....	....
..	..	2	9	M	..	..	..	Oil	18.0	....	..	2	115	SD	....	....	..	..	..	....	....
..	..	1	27	DD	..	..	..	St (146)	14.0	2400	..	2	300	MT	BT BT	3600 3600	0.5 0.5	19.0 19.0	..	....	....
..	..	1	2	M	..	..	..	St (48)	12.0	....	..	2	....	SD	....	....	..	..	..	....	....
..	..	..	..	..	..	..	..	PC-O-G	....	....	..	1	....	....	CET	3600	0.5	1.0	1	8	0.6
..	..	..	..	..	..	..	..	Oil	....	....	..	1	85	SD	....	....	..	..	..	....	....
..	..	1	..	M	..	..	..	St (72)	13.5	2750	..	2	326	SD	....	....	..	..	..	....	....
..	..	..	..	..	..	..	..	.....	....	....	..	....	....	....	BET	3600	0.6	17.0	1	44	....
..	..	..	..	..	..	..	..	.....	....	....	..	....	....	....	BT	3600	0.5	19.0	..	....	....
..	..	..	..	..	..	..	..	.....	....	....	..	....	....	....	BET	3600	2.5	26.0	1	50	....
..	..	..	..	..	..	..	..	.....	....	....	..	....	....	....	BT BT	4036 4036	0.3 0.3	21.0 21.0	..	....	....
..	..	1	13	M	..	..	..	St (81)	10.5	2000	..	....	....	....	CET	3600	1.5	1.0	1	130	1.7

Hydro-Electric Projects Built or On Order in

Company	Designing Engineer	Project Name	[2]New or Redevelop	River	State	Project Started	[1]Dam Type	Crest Length, Feet	Max. Height, Feet	Initial Operation	Initial Cap., Horsepower
NEW ENGLAND STATES											
Central Maine Power Co		Solon	New		Me.	1937	....	....	....	1939	10,950
Public Electric Light Co	Charles T Main, Inc	Milton	New	Lamoille	Vt.	1938	....	....	....	....	4,500
Public Electric Light Co	Charles T Main, Inc	Clark's Falls	New	Lamoille	Vt.	1936	CG	400	40	1938	4,500
Penobscot Chemical Fiber Co		Great Works	.....		Me.	1936	....	....	....	1937	.....
Public Service of N. H		Eastman Falls	.....		N.H.	1936	....	....	....	1937	.....
Great Northern Paper Co		Mattaceunk	New		Me.	1937	....	....	....	1939	11,800
Bangor Hydro Electric Co			.....		Me.	1937	....	....	....	1938	.....
Bangor Hydro Electric Co		Ellsworth	New		Me.	1937	....	....	....	1938	.....
Cumberland County Power & Light Co		Cataract	New		Me.	1937	....	....	....	1938	.....
City of Holyoke	McClintock & Craig	Dickinson	New	Connecticut	Mass.	1937	....	....	....	1938	1,027
Village of Hardwick	Charles T Main, Inc		Redev	Lamoille	Vt.	1937	....	....	....	1938	1,000
Millers Falls Paper Co	Charles T Main, Inc		New	Millers	Mass.	1937	Wood	180	30	1938	750
S D Warren Co			.....		Me.	1936	....	....	....	1937	.....
American Optical Co			Redev	Quinebaug	Mass.	1937	Stone	120	12.5	1938	270
Waterfalls Paper Co			.....		Me.	1936	....	....	....	1937	.....
Madison Woolen Co			.....		Me.	1937	....	....	....	1938	.....
L W Packard & Co, Inc			.....		N.H.	1936	....	....	....	1937	.....
E I du Pont de Nemours & Co		Newhall	New		Me.	1936	....	....	....	1937	.....
City of Lewiston, Me			.....		Me.	1937	....	....	....	1938	.....
Village of Morrisville, Vt			.....		Vt.	....	....	....	....	....	.....
Woonsocket Falls Mill			.....		R.I.	....	....	....	....	....	.....
MIDDLE ATLANTIC STATES											
Niagara Falls Power Co			Redev		N.Y.	....	....	....	....	1938	.....
J P Lewis Co			.....		N.Y.	....	....	....	....	1937	.....
Carthage Paper Makers			.....		N.Y.	1937	....	....	....	1938	.....
Rockland Light & Power Co	Charles T Main, Inc	Swinging Bridge	New Add	Mongaup	N.Y.	1928 1938	Earth	1,000	135	1929	7,000 .....
Elmore Milling Co		Oneonta	.....		N.Y.	....	....	....	....	1937	.....
U. S. Engineer Corps	U. S. Engineer Corps	Lock No. 9	New	Allegheny	Pa.	....	USN	....	....	1938	.....
U. S. Engineer Corps	U. S. Engineer Corps	Dashields Locks.	New	Ohio	Pa.	....	USN	....	....	1938	.....
EAST NORTH CENTRAL STATES											
City of Cincinnati, Ohio	Burns & McDonnell Engrg Co.	Water Works	New	Ohio	Ohio	1936	....	....	....	1937	520
Lake Superior Dist Pwr Co	R S Wilhelm	Port Arthur	Redev	Flambeau	Wisc.	1938	....	....	....	1938	400
Minnesota Utilities Co		Brightdale	Redev	Root	Minn.	1938	....	....	....	1938	.....
Wisconsin Public Service Corp		Tomahawk	New		Wisc.	1937	....	....	....	1938	4,140
Wisconsin Public Service Corp		Grand Fathers Falls	New		Wisc.	1937	....	....	....	1938	.....
Illinois Iowa Power Co		Marseilles	.....		Ill.	1937	....	....	....	1938	.....
Village of Paw Paw			.....		Mich.	1937	....	....	....	1938	.....
City of Big Rapids			.....		Mich.	1936	....	....	....	1937	.....
Westfield Milling & Electric Co			.....		Wisc.	1937	....	....	....	1938	.....
WEST NORTH CENTRAL STATES											
Southern Nebraska Power Co		Superior	.....		Neb.	1937	....	....	....	1938	.....
Central Neb. Power & Irr Dist	Central Neb. Pwr & Irr Dist.	Tri-County	New	Platte	Neb.	1938	....	....	....	....	26,000
Northern States Power Co			.....		Minn.	1937	....	....	....	1938	.....
L D Croswell Lt & Pwr Co			.....		Minn.	1937	....	....	....	1938	.....
Loup River Public Power Dist	Harza Engineering Co	Monroe	New	Loup	Neb.	1934	P&G	840	14	1937	9,600
Loup River Public Power Dist	Harza Engineering Co	Columbus	New	Loup	Neb.	1934	P&G	840	14	1937	54,000
Kansas Power & Light Co		Rock Ford	.....		Kan.	1936	....	....	....	1937	.....
Pickands, Mather & Co		Vulcan Mines	.....		Minn.	1936	....	....	....	1937	.....
SOUTH ATLANTIC STATES											
Appalachian Electric Power Co			New	New	Va.	1937	....	....	....	1939	.....
Potomac Edison Co			New		W.Va.	1936	....	....	....	1937	.....
City of Danville, Va	Charles T Main, Inc	Pinnacles	New	Dan	Va.	1936	Arch Arch	575 520	130 140	....	13,500
Greenwood County Board of Comm		Buzzards	New	Saluda	S.C.	....	Earth	2,000	85	1939	22,200
Washington Mills		Fries	.....		Va.	1936	....	....	....	1937	.....
Whitney Mfg Co		Spartansberg	.....		S.C.	1936	....	....	....	1937	.....
Athens Mfg Co			New		Ga.	1936	....	....	....	1937	.....
Kanawha Valley Power Co	Am Gas & Electric Co	Winfield	New	Kanawha	W.Va.	1936	USN	....	....	1938	27,550
Northwest Carolina Utilities Co			.....		N.C.	1937	....	....	....	1938	.....
Victor Monaghan Co		Appalache	New		S.C.	1936	....	....	....	1937	.....
Occoquan Hydro-Electric Co			.....		Va.	1936	....	....	....	1937	.....
W J Dickey & Sons	Joel D Justin		Redev	Patapsco	Md.	1937	....	....	....	1937	.....
Sellers Mfg Co		Saxapahaw	.....		N.C.	1938	....	....	....	1939	.....
Jackson Mills		Plant 3	.....		N.C.	1937	....	....	....	1938	.....
A D Julliard Co		Brookford	.....		N.C.	1937	....	....	....	1938	.....
Piedmont Mfg Co		Piedmont	.....		S.C.	1936	....	....	....	1937	.....
Meadow Creek Corp	S C Foster	New Castle	.....	Meadow Cr.	Va.	1937	CG	35	13	1938	900
Graniteville Mfg Co		Graniteville	.....		S.C.	1936	....	....	....	1937	.....
EAST SOUTH CENTRAL STATES											
U. S. Tenn. Valley Authority	Tenn. Valley Auth	Pickwick	New	Tennessee	Tenn.	1935	EF	7,715	113	1938	110,000
U. S. Tenn. Valley Authority	Tenn. Valley Auth	Chickamauga	New	Tennessee	Tenn.	1936	CG	5,794	108	1940	108,000
U. S. Tenn. Valley Authority	Tenn. Valley Auth	Guntersville	New	Tennessee	Ala.	1935	CG	3,985	94	1940	102,000
U. S. Tenn. Valley Authority	Tenn. Valley Auth	Hiwassee	New	Hiwassee	N.C.	1937	CG	1,265	307.5	1941	80,000
Aluminum Co of America	Aluminum Co of Amer	Calderwood	New	Little Tenn.	Tenn.	1928	CA	....	....	1930	112,000
U. S. Engineer Corps	U. S. Engineer Corps	Tuscaloosa	New		Ala.	....	USN	....	....	1938	174
WEST SOUTH CENTRAL STATES											
Red Bluff Water Pwr Con Dist	Vernon L Sullivan	Red Bluff	New	Pecos	Texas	1934	SH	9,150	104	1937	3,950
Lower Colorado River Auth	Fargo Engrg Co & LCRA	Buchanan	New	Colorado	Texas	1936	GMA	11,000	146	1938	34,600
Lower Colorado River Auth	Lower Colo River Auth	Tom Miller	New	Colorado	Texas	1938	CG	1,200	112.5	1940	20,000
Lower Colorado River Auth	Fargo Engrg Co & LCRA	Inks Dam	New	Colorado	Texas	1936	CG	1,500	98	1938	16,000
Grand River Dam Authority	Holway & Neuffer	Pensacola Dam	New	Grand	Okla.	1938	MA	6,100	150	....	80,000

(For key to symbols, see next page)

the United States and Canada in 1937 and 1938

Added Cap., No. of Units	Date of Added Cap.	Ultimate Cap. Horsepower	No. of Units Installed	Water-Wheel Capacity, Horsepower	Water Wheel, Type	Speed, RPM	Static Head, Ft	Design Head, Ft	[1]Water-Wheel Manufacturer	[1]Governor, Manufacturer	Draft Tube, Type	Scroll Case, Type	Penstock Valves, Type	Generator Capacity, Kva	[2]Thrust-Bearing Location	Power Factor	Kilovolts	Cycles	[1]Generator Manufacturer
....	....	.....	1	10,950	Kaplan	150	45	45	MS	....	Elbow	Concrete	Head Ga	8,000	BG	0.80	6.9	60	GE
....	....	9,000	1	4,500	Francis	277	100	95	MS	L	Elbow	Plate St	Head Ga	3,750	AG	0.80	2.4	60	GE
....	....	4,500	1	4,500	Kaplan	240	42	40	MS	L	Elbow	Plate St	Head Ga	3,750	AG	0.80	2.4	60	GE
....	....	.....	1	1,300	Francis	240	17	17	JL	W	Elbow	.....	Head Ga	500	HS	....	0.125	DC	GE
....	....	.....												875	HS	0.80	0.6	60	GE
....	....	.....	1	2,650	Kaplan	240	33	33	MS	W	Elbow	.....	Head Ga	2,250	AG	0.80	2.4	60	GE
....	....	.....	2	5,900	Kaplan	171.4	39	39	BS	W	.....	.....	.....	6,000	AG	0.80	6.9	60	GE
....	....	.....	2	2,070	.....	128	20	20	....	W	.....	.....	.....	1,875	AG	0.80	6.9	60	GE
....	....	.....	1	2,900	Kaplan	360	63	60	MS	W	Elbow	Plate St	Head Ga	2,500	AG	0.80	2.4	60	GE
....	....	.....	1	9,000	Kaplan	164	44	44	MS	W	Elbow	Concrete	Head Ga	9,500	AG	0.80	11.5	60	GE
....	....	1,027	1	1,027	Kaplan	180	18	18	MS	W	.....	Welded St	Head Ga	1,000	AG	0.80	4.8	60	GE
....	....	1,000	1	1,000	Kaplan	514	50–46	50	MS	L	Curved	Open Flume	Head Ga	1,000	AG	0.70	2.3	60	GE
1	1938	1,950	1	1,287	Kaplan	277	30	30	MS	W	Elbow	Concrete	Head Ga	1,250	AG	0.80	0.6	60	GE
....	....	.....	1	.....	.....	720	.....	....	....	....	.....	.....	.....	312	HS	0.80	0.48	60	GE
....	....	270	1	270	Kaplan	200	10	10	MS	L	Elbow	Open Flume	.....	250	AG	0.80	0.6	60	GE
....	....	.....	1	.....	.....	257	.....	....	....	....	.....	.....	.....	312	HS	0.80	2.4	60	WE
....	....	.....	2	.....	.....	327	.....	....	....	....	.....	.....	.....	312	AG	0.80	6.60	60	GE
....	....	.....	1	400	.....	400	31	31	....	W	.....	.....	.....	375	AG	0.80	0.24	60	WE
....	....	.....	1	300	Francis	300	24	24	JL	W	.....	.....	.....	260	AG	0.80	6.6	60	GE
....	....	.....	1	1,140	Francis	200	36	36	JL	....	.....	.....	.....	875	AG	0.80	2.3	60	AC
....	....	.....	1	1,040	Francis	227	39	39	JL	....	.....	.....	Head Ga	.....	HS	....	....	60	WE
....	....	.....	1	250	Francis	225	18	18	JL	....	.....	.....	Head Ga	.....	.....	....	....	60	GE
....	....	.....	2	10,000	.....	300	.....	212	....	W	.....	.....	.....	10,000	HS	0.80	12.0	60	GE
....	....	.....	1	2,070	.....	150	30	30	....	W	.....	.....	.....	1,875	AG	0.8	2.4	60	GE
....	....	.....	1	1,140	.....	150	.....	....	....	....	.....	.....	.....	1,000	AG	0.8	2.4	60	GE
....	....	17,800	1	7,000	.....	....	.....	....	....	....	.....	.....	.....	5,000	AG	0.9	4.0	60	.....
1	1939	17,800	1	10,800	Francis	120	125–95	120	MS	W	Elbow	Plate St	Head Ga	7,500	AG	0.9	4.0	60	WE
....	1938	.....	1	238	Francis	140	15	15	JL	W	.....	.....	Head Ga	200	AG	....	....	60	GE
			1	368	Francis	112	15	15	JL	W	.....	.....	Head Ga	300	AG	....	....	60	GE
			2	83.3	Francis	360	22	22	JL		Operates navigation canal locks			.....	.....	....	....	..	.....
....	....	.....	1	64	Francis	370	22	22	JL	W	.....	.....	.....	25	dc machine	....	0.25	..	WE
....	....	.....	2	92.5	Francis	170	14	14	JL		Operates navigation canal locks			.....	.....	....	....	..	.....
....	....	780	2	260	Francis	327	48	30	JL	W	Elbow	.....	Gate	219	AG	0.80	4.15	60	WE
1	1938	.....	1	400	Francis	170	18	18	JL	W	.....	.....	Head Ga	250	HS	0.80	2.3	60	EM, AC
....	....	.....	1	585	Francis	164	30	30	JL	W	.....	.....	Head Ga	625	AG	0.80	2.3	60	EM
....	....	4,140	2	2,070	Kaplan	120	16.5	16.5	MS	W	Elbow	Concrete	Head Ga	1,875	AG	0.80	....	60	AC
....	....	.....	1	14,700	Francis	180	95	91	MS	W	Elbow	Plate St	Head Ga	13,750	AG	0.80	6.9	60	AC
			1	8,400	Francis	200	95	91	MS	W	Elbow	Plate St	Head Ga	7,860	AG	0.80	6.9	60	AC
....	....	.....	1	382	Francis	120	13.5	13.5	JL	W	Elbow	.....	Head Ga	325	AG	0.80	....	60	GE
....	....	.....	1	365	.....	240	15	15	....	W	.....	.....	.....	312	AG	0.80	2.4	60	GE
....	....	.....	2	240	.....	360	17	17	....	W	.....	.....	.....	219	AG	0.80	0.48	60	EM
....	....	.....	1	260	.....	450	17	17	....	W	.....	.....	.....	250	AG	0.80	2.3	60	EM
....	....	.....	1	450	Francis	200	20	20	JL	....	.....	.....	.....	400	AG	....	....	60	EM
....	....	.....	2	13,000	Francis	180	116-106	113	MS	W	Elbow	Plate St	Head Ga	10,000	AG	0.90	6.9	60	AC
....	....	.....	1	947	Francis	180	17.5	17.5	JL	....	.....	.....	.....	750	AG	0.80	2.3	60	EM
....	....	.....	1	350	Francis	360	37	37	JL	W	.....	.....	.....	250	AG	0.80	2.4	60	EM
....	....	.....	3	3,200	Francis	112.5	32–36	32	JL	W	[5]ES	Concrete	Head Ga	2,750	BG	0.95	6.9	60	WE
....	....	.....	3	18,000	Francis	150	109–116	112	BS	W	[5]ES	Plate St	Head Ga	14,000	BG	0.95	13.8	60	AC
....	....	.....	1	710	Francis	120	19	19	JL	....	.....	.....	Head Ga	625	AG	....	....	60	GE
....	....	.....	4	900	Francis	180	24	24	JL	....	.....	.....	Head Ga	750	HS	....	....	60	GE
....	....	.....	4	26,000	Francis	138.5	.....	110	2NN, 2AG	W	.....	.....	.....	20,833	BG	0.90	11.5	60	WE
....	....	.....	1	1,500	.....	212	24	24	....	W	.....	.....	.....	1,250	AG	0.80	2.4	60	WE
....	....	13,500	3	4,500	Impulse	450	680–701	660	MS	W	.....	.....	Butterfly	3,750	AG	0.90	4.16	60	GE
....	....	30,000	3	7,400	Kaplan	240	60	60	BS	W	.....	.....	.....	6,250	AG	0.80	4.15	60	GE
....	....	.....	1	1,210	Francis	277	36	36	JL	W	.....	.....	Head Ga	1,000	AG	0.80	0.48	60	EM
....	....	.....	1	225	Francis	192	20	20	JL	W	.....	.....	Head Ga	.....	.....	....	....	..	GE
....	....	.....	1	430	Francis	180	16	16	JL	....	.....	.....	Head Ga	.....	.....	....	....	..	WE
			1	290	Francis	225	18	18	JL	W	.....	.....	Head Ga	.....	.....	....	....	..	WE
....	....	27,550	2	9,200	Kaplan	90	26	26	BS	W	Elbow	Concrete	Head Ga	6,150	BG	0.90	4.15	60	GE
			1	9,150	[6]AAP	90	26	26	NN	W	Elbow	Concrete	Head Ga	6,150	BG	0.90	4.15	60	GE
....	....	.....	1	590	Francis	180	14	14	JL	W	.....	.....	.....	.....	.....	....	....	..	GE
....	....	.....	1	1,000	Francis	300	40	40	JL	W	.....	.....	Head Ga	875	AG	0.80	2.4	60	AC
....	....	.....	1	100	Francis	450	22	22	JL	W	.....	.....	Head Ga	94	AG	0.80	2.4	60	EM
....	....	.....	1	840	Kaplan	514	43	43	MS	W	.....	.....	Head Ga	750	AG	0.80	0.6	60	GE
....	....	.....	1	1,520	Francis	150	28	28	JL	....	.....	.....	Head Ga	1,350	AG	....	....	60	GE
....	....	.....	1	890	Francis	120	28	28	JL	....	.....	.....	Head Ga	750	AG	....	....	60	AC
....	....	.....	1	2,500	.....	360	33	33	....	W	.....	.....	Head Ga	2,000	AG	0.80	4.15	60	GE
....	....	.....	1	500	Francis	200	27	27	JL	W	.....	.....	Head Ga	438	AG	0.80	0.6	60	WE
....	....	.....	1	1,600	.....	150	28	28	....	W	.....	.....	Head Ga	1,250	AG	0.80	0.6	60	GE
....	....	450	1	450	Impulse	720	610–570	61	MS	W	.....	.....	.....	375	HS	0.80	2.4	60	WE
....	....	.....	1	610	Francis	327	40	40	JL	W	.....	.....	Head Ga	563	AG	0.80	0.6	60	WE
....	....	330,000	2	55,000	Kaplan	81.0	60–30	47	AC	AC	Elbow	Concrete	Head Ga	40,000	BG	0.90	13.8	60	WE
....	....	144,000	3	36,000	Kaplan	75	36	36	BS	W	Elbow	Concrete	Head Ga	30,000	BG	0.90	13.8	60	AC
....	....	136,000	3	34,000	Kaplan	69.2	36	36	MS	W	Elbow	Concrete	Head Ga	27,000	BG	0.90	13.8	60	GE
....	....	160,000	1	80,000	Francis	120	195	190	NN	W	Elbow	.....	.....	.....	.....	....	....	..	.....
1	1938	168,000	2	56,000	Francis	150	.....	213	AC	AC	Elbow	Cast St	.....	45,000	AG	0.90	13.2	60	WE
			1	56,000	Francis	150	.....	213	AC	AC	Elbow	Cast St	.....	45,000	AG	0.90	13.2	60	WE
....	....	174	2	87.3	Francis	250	16	16	JL		Operates navigation canal locks			.....	.....	....	....	..	.....
....	....	.....	1	2,200	Francis	277	38–86	60	MS	W	[5]VS	Plate St	Butterfly	1,650	AG	0.80	2.4	60	GE
			1	1,750	Francis	360	38–86	60	MS	W	[5]VS	Plate St	Butterfly	1,260	AG	0.80	2.4	60	GE
....	....	52,000	2	17,300	Francis	171.4	133-73	115	NN	W	Elbow	Plate St	Head Ga	12,500	BG	0.90	6.9	60	WE
....	....	20,000	2	10,000	[6]AAP	200	64–30	60	NN	W	Elbow	Concrete	Head Ga	7,500	BG	0.90	12.0	60	WE
....	....	.....	1	16,000	Francis	112.5	64–30	63.5	MS	W	Elbow	Concrete	Head Ga	12,500	BG	1.00	6.9	60	GE
....	....	100,000	4	20,000	Francis	150	135–85	115	AC	W	Elbow	Plate St	Head Ga	16,000	BG	0.90	13.8	60	WE
			1	750	Francis	720	135–85	115	AC	W	.....	.....	.....	625	HS	0.80	0.48	60	WE

(Continued on next two pages)

Hydro-Electric Projects Built or On Order in

Compiled by F A Annett, *Associate Editor* Company	Designing Engineers	Project Name	[2]New or Redevelop	River	State, Province or Country	Project Started	[4]Dam Type	Crest Length, Feet	Max. Height, Feet	Initial Operation	Initial Cap., Horsepower
MOUNTAIN STATES											
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Boulder Dam	New	Colorado	Ariz. & Neb.	1931	GA	1,180	730	1936	515,000
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Boulder Dam	New	Colorado	Ariz. & Neb.	....	GA	1,180	730	....	.....
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Elephant Butte	New	Rio Grande	N. M.	1911	CG	1,162	306	1940	34,500
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Green Mt	New	Blue	Colo.	1938	EF	1,300	270	1943	30,000
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Kendrick	New	N Platte	Wyo.	1935	CA	540	261	1939	45,000
Rocky Mountain Pwr Co	Phoeni Engrg Corp	Kerr	New	Flathead	Mont.	1930	CA	385	170	1938	77,000
Idaho Power Co	Phoenix Engrg Corp	Upper Salmon	New	Snake	Idaho	1937	CG	1,618	14	1937	26,000
Jardine Mining Co	.....	.....	.....	.....	Mont	1936	.....	....	...	1937	.....
U. S. Engineer Corps	.....	Conchas Dam	New	.....	N. M.	1936	.....	....	...	1937	.....
U. S. Bureau of Reclamation	U. S. Bureau of Reclam	Succor Creek—1.	New	.....	Idaho	1937	.....	....	...	1938	.....
U. S. Bureau of Reclamation	U. S. Bureau of Reclam	Succor Creek—2.	New	.....	Idaho	1937	.....	....	...	1938	.....
Gardner Elec Lt & Water Co	.....	.....	.....	.....	Mont.	1936	.....	....	...	1937	.....
Strawberry Water Users Assn	.....	Payson	New	.....	Utah	1936	.....	....	...	1937	.....
Lower Valley Pwr & Lt Co	.....	Afton	New	.....	Wyo.	1937	.....	....	...	1938	.....
City of Monroe	.....	.....	Redv	.....	Utah	....	.....	....	...	1938	.....
PACIFIC COAST STATES											
City of San Francisco	.....	Moccasin Creek	Redev	.....	Calif.	....	.....	....	...	....	.....
U. S. Government	U. S. Engineer Corps	Bonneville	New	Columbia	Wash & Ore.	1933	CG	900	170	1938	137,000
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Grand Coulee	New	Columbia	Wash.	1934	CG	4,500	553	1941	478,000
U. S. Bureau of Reclamation	U. S. Bur of Reclam	Shasta	New	Sacramento	Calif.	1938	CG	3,500	560	1943	400,000
City of Spokane Water Div	Eng Bureau Water Div	Upriver	Redev	Spokane	Wash.	1935	.....	208	37	1937	5,400
Imperial Irrigation Dist	U. S. Bureau of Reclam	Drop No. 4	New	A A Canal	Calif.	1937	.....	None	...	1940	13,300
Quinault Lighting Co	.....	Zeigler Creek	New	.....	Wash.	1937	.....	....	...	1938	375
Champion-Sillimanite, Inc	.....	Shealy	.....	.....	Calif.	1936	.....	....	...	1937	350
Pend Orielle Mines & Metals Co	G A Pehrson	.....	New	Pend Oreille	Wash.	1936	.....	....	...	1937	2,250
Mountain States Power Co	.....	.....	New	.....	Ore.	1936	.....	....	...	1937	.....
Enterprise Irrigation Dist	W S Turner & Co, Inc	.....	New	.....	Ore.	1937	.....	....	...	1938	750
County Cooperative Elec Assn	W S Turner & Co, Inc	.....	New	.....	Ore.	1937	.....	....	...	1938	.....
Pacific Power & Light Co	.....	Wallowa Falls	Redv	.....	Ore.	1937	.....	....	...	1938	.....
UNITED STATES POSSESSIONS											
Ketchikan Public Utility	.....	Ketchikan	New	.....	Alaska	1937	.....	....	...	1938	.....
U. S. Dept of the Interior	.....	Metlakatla	New	.....	Alaska	1936	.....	....	...	1937	.....
CANADA											
Gatineau Power Co	A H White, Chief Eng International Paper Co	Chelsea	New	Gatineau	Que.	1925	CG	1,600	110	1927	136,000
Great Lakes Pwr Co Ltd	Harza Engrg Co	Lower Falls	New	Montreal	Ont.	1937	.....	1,400	32	1938	12,350
Great Lakes Pwr Co Ltd	Harza Engrg Co	Upper Falls	New	Montreal	Ont.	1936	EF	775	32	1937	10,000
Ontario Hydro-Elec Pwr Comm	Hydro-Elec Pwr Comm	Ragged Rap	New	Musquash	Ont.	1937	CG	485	34	1938	11,000
Ontario Hydro-Elec Pwr Comm	Hydro-Elec Pwr Comm	Ear Falls	New	English	Ont.	1936	CG	60	46	1937	10,000
Churchill River Pwr & Lt Co Ltd	.....	Island Falls	New	.....	Sask.	1936	.....	....	...	....	57,000
Ontario Paper Co, Ltd	H G Acres & Co, Ltd	Outarde Falls	New	Outarde	Que.	1936	CG	275	50	1937	70,600
Polaris Taku Mines, Ltd	.....	Tulsequath	.....	Talsekwa	B. C.	1937	.....	....	...	1937	.....
Slingsby Mfg Co	.....	Brantford	New	.....	Ont.	1937	.....	....	...	1937	.....
Western Pwr Co of Canada	Company Engineers	Ruskin	New	Stave	B. C.	1929	CG	370	195	1930	47,000
City of Winnipeg	Winnepeg Eng Dept	Slave Falls	New	Winnepeg	Man.	1929	.....	....	...	1931	24,000
Proprietary Mines, Ltd	.....	Raven Lakes	Redev	.....	Ont.	1937	.....	....	...	1937	725
Saguenay Power Co	W S Lee Engrg Co	Ile Maligne	New	Saguenay	Que.	1923	.....	....	...	1925	.....
Donnacona Paper Co	Company Engineers	Bird Mill	Redev	Jac Cartier	Que.	1937	CP&SL	144	36	1937	.....
Minas Basin Pulp & Paper Co	.....	Salmon Hole	New	St. Croix	N. S.	1937	.....	....	...	1938	2,500
Nova Scotia Power Comm	Nova Scotia Pwr Comm	Cowie Falls	New	Mersey	N. S.	1937	EF	2,080	42	1938	10,200
Dryden Paper Co Ltd	Power Corp of Canada	McKenzie Falls	New	Eagle	Ont.	1937	CG	96	18	1938	1,485
Digby County Power Board	.....	.....	.....	.....	N. S.	1938	.....	....	...	1939	.....
Bobcaygeon Lt & Pwr Co	.....	.....	.....	.....	Ont.	1938	.....	....	...	1939	.....
Berens River Mines, Ltd	.....	Favorable Lake	New	.....	Ont.	1938	.....	....	...	1939	2,000
Electric Reduction Co of Canada	.....	.....	.....	.....	Que.	1937	.....	....	...	1938	.....
Consolidated Mining & Smelting Co, Ltd	.....	Big Missouri	.....	.....	B. C.	1937	.....	....	...	1938	.....
Consolidated Mining & Smelting Co, Ltd	.....	Goldfields	.....	.....	Sask.	1937	.....	....	...	1938	.....
Mattawa Elec Lt & Pwr Co, Ltd	.....	.....	New	.....	Ont.	1936	.....	....	...	1937	.....
Pacific Mills, Ltd	.....	.....	Recon	.....	B. C.	1937	.....	....	...	1938	.....
Pacific Mills, Ltd	.....	.....	Recon	.....	B. C.	1937	.....	....	...	1938	.....
Electric Light & Power Service	.....	Blind River	.....	.....	Ont.	1937	.....	....	...	1938	.....
Belleterre Que Mines, Ltd	.....	Winneway	.....	.....	Que.	1937	.....	....	...	1938	.....
Beauharnois Pwr, Ht & Lt Co	.....	Beauharnois	New	St Lawrence	Que.	1929	P&G	4,500	31	1932	228,000
Price Brothers & Co, Ltd	.....	Kenogami	Reconst	.....	Que.	....	.....	....	...	....	.....
Canadian Niagara Power Co, Ltd	.....	.....	Reconst	.....	Ont.	....	.....	....	...	....	.....
FOREIGN											
Anglo-Newfoundland Dev Co	.....	Grand Falls	New	.....	Newfoundland	1937	.....	....	...	....	.....
Aromayo Mining Co	.....	Gritado	New	.....	Bolivia, S. A.	....	.....	....	...	....	.....
Andes Copper Mining Co	.....	Sifon Bajo	New	.....	Chile, S. A.	....	.....	....	...	....	.....
Mauricio Hochschild	.....	.....	New	.....	Bolivia, S. A.	....	.....	....	...	....	.....

[1]AC —Allis-Chalmers Mfg Co
MS —S Morgan Smith Co
JL —James Leffel & Co
PW —Pelton Water Wheel Co
BS —Baldwin Southwark Corp
NN —Newport News Shipbuilding & Dry Dock Co
W —Woodward Governor Co
L —Lombard Governor Co
DEW—Dominion Engrg Works, Ltd
CAC —Canadian Allis Chalmers, Ltd
MSI —S Morgan Smith-Inglis, Ltd
GE —General Electric Co
WE —Westinghouse Elect. & Mfg Co
EM —Electric Machinery Mfg Co
EC —Elliott Co
CWC—Canadian Westinghouse Co, Ltd
CGE —Canadian General Electric Co, Ltd
EEC —English Electric Co of Canada, Ltd
SGE —Swedish General Electric Co, Ltd
OC —Oerlikon Canada, Ltd
IGE —International General Electric Co

the United States and Canada in 1937 and 1938

Added Cap., No. of Units	Date of Added Cap.	Ultimate Cap. Horsepower	No. of Units Installed	Water-Wheel Capacity, Horsepower	Water Wheel, Type	Speed, RPM	Static Head, Ft	Design Head, Ft	[1]Water-Wheel Manufacturer	[1]Governor Manufacturer	Draft Tube, Type	Scroll Case, Type	Penstock Valves, Type	Generator Capacity, Kva	[3]Thrust-Bearing Location	Power Factor	Kilovolts	Cycles	[1]Generator Manufacturer
			4	115,000	Francis	180	584–422	520	AC	W	Elbow	Cast St	Butterfly	82,500	AG	1.00	16.5	60	2 WE 2 GE
..	....	1,835,000	1	55,000	Francis	237	584–422	520	NN	W	Elbow	Cast St	Butterfly	40,000	AG	1.00	13.8	60	AC
			2	3,500	Pelton	300	584–422	520	PW	W	House Service		.....	3,000	HS	0.80	2.4	60	EM
2	1938	.....	2	115,000	Francis	180	584–422	520	PW	W	Elbow	Cast St	Butterfly	82,500	AG	1.00	16.5	60	GE
2	1939	.....	2	115,000	Francis	180	584–422	520	AC	W	Elbow	Cast St	Butterfly	82,500	AG	1.00	16.5	60	WE
..	....	34,500	3	11,500	Francis	257	205–70	156	.....	.....	Elbow	Plate St	Head Ga	9,000	AG	0.90	6.9	60	AC
..	....	30,000	2	15,000	Francis	257	262–107	203	.....	.....	Elbow	Plate St	Head Ga	12,000	AG	0.90	6.9	60	AC
..	....	45,000	3	15,000	Francis	225	221–116	195	PW	W	Elbow	Plate St	Head Ga	12,000	AG	0.80	6.9	60	AC
..	....	154,000	1	77,000	Francis	112.5	193–169	189	NN	W	Elbow	Plate St	Head Ga	56,000	BG	0.10	13.8	60	WE
..	....	26,000	2	13,000	Propeller	138.5	47	44	MS	MS	[5]EHS	Concrete	Head Ga	9,000	BG	1.0	6.9	60	1 WE 1 GE
..	....	.....	1	983	Impulse	600	875	850	PW	W	.....	.....	.....	750	HS	0.80	4.6	60	GE
..	....	.....	1	220	.....	1,200	.....	150	.....	W	.....	.....	.....	187.5	AG	0.80	0.48	60	GE
..	....	.....	1	128	Francis	882	70	70	JL		Drives centrifugal pump		.....	.....	....	....	....	..	.....
..	....	.....	1	133	Francis	940	55	53	JL		Drives centrifugal pump		.....	.....	....	....	....	..	.....
..	....	.....	1	.....	.....	900	.....	.....	.....	.....	.....	.....	.....	125	HS	0.80	2.4	60	GE
..	....	.....	1	350	Francis	200	48	48	JL	W	.....	.....	.....	312	AG	0.80	2.3	60	WE
..	....	.....	1	400	Francis	450	36	36	JL	W	.....	.....	.....	375	AG	0.80	2.5	60	WE
..	....	.....	1	184	Impulse	1,200	.....	1,331	PW	W	Reconstruction project		.....	.....	....	....	....	..	.....
..	....	.....	4	28,000	Impulse	257	.....	1,250	PW		Reconstruction project		.....	.....	....	....	....	..	.....
			2	66,000	Kaplan	75	67–22	50	MS	W	[5]EHS	Concrete	Head Ga	54,000	BG	0.80	13.8	60	GE
2	1940	665,000	1	5,000	Kaplan	257	67–22	50	MS	W	Elbow	Plate St	Head Ga	3,200	AG	0.80	2.4	60	EM
			2	74,000	Kaplan	75	67–22	60	MS	W	[5]EHS	Concrete	Head Ga	60,000	BG	0.80	13.8	60	GE
..	....	2,742,000	3	150,000	Francis	120	358–266	330	.....	.....	Elbow	Plate St	Head Ga	108,000	AG	1.0	13.8	60	WE
			2	14,000	Francis	400	358–266	335	PW	.....	Service units		.....	12,500	AG	0.80	6.6	60	WE
..	....	500,000	4	100,000	Francis	150	480–243	350	.....	.....	Elbow	Plate St	Head Ga	75,000	....	1.00	13.8	60	.....
..	....	5,400	3	1,800	Kaplan	200	34	33	AC	AC	Elbow	Concrete	Head Ga	1,625	AG	0.80	2.3	60	AC
..	....	26,600	1	13,300	Propeller	150	49–56	51	NN	W	Elbow	Concrete	Head Ga	12,000	AG	0.80	6.9	60	EC
..	....	.....	1	375	Impulse	900	.....	845	PW	W	.....	.....	.....	312.5	HS	0.80	2.4	60	GE
..	....	.....	1	350	Impulse	1,200	.....	1,100	AC	W	.....	.....	.....	300	HS	0.80	2.3	60	AC
..	....	4,500	1	2,250	Kaplan	180	27–18	24	MS	W	Elbow	Concrete	Head Ga	2,250	AG	0.80	2.4	60	EM
..	....	.....	1	.....	.....	164	.....	.....	.....	.....	.....	.....	.....	750	AG	0.80	2.4	60	WE
..	....	.....	1	750	Francis	138	23	22.5	JL	W	Elbow	.....	Head Ga	625	AG	0.80	2.4	60	WE
..	....	.....	1	225	Francis	1,200	240	230	JL	.....	.....	.....	.....	187	HS	0.80	2.4	60	WE
..	....	.....	1	1,200	Impulse	514	.....	1,070	PW		Reconstruction project		.....	.....	....	....	....	..	.....
..	....	.....	1	2,500	Francis	720	270	260	PW	W	.....	.....	.....	1,750	HS	0.80	4.16	60	GE
..	....	.....	1	400	Impulse	900	775	750	PW	W	.....	.....	.....	312	HS	0.80	2.4	60	WE
			1	34,000	Francis	100	93	93	DEW	W	Moody	Concrete	Head Ga	32,000	AG	0.90	6.6	25	CWC
1	1938	170,000	3	34,000	Francis	100	93	93	DEW	W	Moody	Concrete	Head Ga	36,000	AG	0.90	6.6	60	CWC
			1	34,000	Francis	100	93	93	DEW	W	Moody	Concrete	Head Ga	36,000	AG	0.85	6.6	60	CWC
..	....	24,700	1	12,350	Francis	257	205	200	MSI	W	Elbow	Plate St	Head Ga	9,000	BG	0.9	11.0	60	CGE
..	....	25,000	1	10,000	Francis	277	190	186	MSI	W	Elbow	Plate St	Head Ga	10,000	BG	0.90	11.0	60	CGE
..	....	11,000	2	5,500	Kaplan	200	40	38	MSI	W	Elbow	Concrete	Head Ga	4,500	AG	0.85	6.6	60	CWC
..	....	25,000	2	5,000	Propeller	180	44–26	36	MSI	W	[5]VS	Concrete	Head Ga	4,500	AG	0.85	6.6	60	OC
1	1937	76,000	4	19,000	Propeller	150	56	56	DEW	W	.....	Concrete	Head Ga	18,000	AG	0.90	6.6	60	CGE
1	1939	95,000	5	19,000	Propeller	150	56	56	DEW	W	.....	Concrete	Head Ga	18,000	AG	0.90	6.6	60	CGE
..	....	.....	2	35,300	Francis	180	231–222	208	CAC	W	Elbow	Plate St	Butterfly	26,315	AG	0.95	6.6	60	CGE
..	....	.....	1	700	.....	1,200	.....	.....	.....	.....	.....	.....	.....	625	HS	0.80	0.48	60	EEC
..	....	.....	1	450	.....	500	16	16	.....	W	.....	.....	.....	438	HS	0.80	2.3	60	EEC
1	1938	158,000	2	47,000	Francis	120	130–104	125	DEW	W	Moody	Plate St	Pivot	44,000	BG	0.80	13.8	60	CWC
1	1937	96,000	3	12,000	Propeller	94.7	33–22	30	DEW	W	.....	Concrete	Head Ga	10,000	AG	1.00	6.6	60	SGE
1	1938	.....	4	12,000	Propeller	94.7	33–22	30	DFW	W	.....	Concrete	Head Ga	10,000	AG	1.00	6.6	60	SGE
..	....	925	1	725	Propeller	300	28	28	CAC	W	.....	.....	Butterfly	700	HS	0.80	2.5	60	CGE
1	1937	540,000	12	45,000	Francis	112.5	127–87	110	CAC	CAC	Hydrocone	Plate St	Butterfly	35,000	AG	....	....	60	CWC
..	....	.....	1	2,250	Propeller	80	26	26	DEW	W	Elbow	Open flume	.....	2,400	AG	0.80	0.55	60	CWC
..	....	.....	1	2,500	Francis	277	75	75	DEW	W	Elbow	Plate St	.....	2,500	AG	0.80	2.3	60	SGE
..	....	.....	2	5,100	Kaplan	200	44–41	43	MSI	W	Elbow	Concrete	Head Ga	4,000	AG	0.90	6.6	60	OC
..	....	1,485	1	1,485	Kaplan	240	28	26	MSI	W	Elbow	Concrete	Head Ga	1,400	AG	0.80	2.4	60	CGE
..	....	.....	1	550	.....	450	36	36	.....	W	.....	.....	.....	450	HS	0.80	2.3	60	CGE
..	....	.....	1	216	Propeller	90	5.4	5.4	CAC	W	.....	.....	.....	187	BG	0.80	2.3	60	CGE
..	....	.....	2	1,000	.....	400	57	57	.....	W	.....	.....	.....	750	AG	0.80	2.3	60	CGE
..	....	.....	1	2,500	Propeller	225	32	32	CAC	W	.....	.....	.....	2,040	AG	0.90	2.3	60	CGE
..	....	.....	2	1,700	Impulse	400	525	500	PW	.....	Reconstruction project			.....	....	....	....	..	.....
..	....	.....	1	3,300	Francis	300	70	70	CAC	W	Elbow	.....	Butterfly	3,000	HS	0.80	2.3	60	CGE
..	....	.....	1	830	Kaplan	257	22	22	MSI	W	.....	Pressure flume		600	AG	0.80	2.3	60	SGE
..	....	.....	1	6,360	Francis	360	.....	149	PW	.....	Reconstruction project			.....	....	....	....	..	.....
..	....	.....	6	2,100	Francis	240	.....	136	PW	.....	Reconstruction project			.....	....	....	....	..	.....
..	....	.....	1	750	Francis	450	.....	75	CAC	W	.....	.....	.....	530	HS	0.80	2.3	60	SGE
..	....	.....	1	1,400	Francis	257	54	54	CAC	W	.....	.....	.....	1,375	HS	0.80	2.3	60	EEC
			4	53,000	Francis	75	83	80	DEW	DEW	Elbow	Concrete	Head Ga	43,482	BG	0.85	13.2	25	3 CGE 1 OC
1	1938	636,000	4	53,000	Francis	75	83	80	DEW	DEW	Elbow	Concrete	Head Ga	46,425	BG	0.80	13.2	60	CGE
			1	53,000	Francis	75	83	80	DEW	DEW	Elbow	Concrete	Head Ga	46,625	BG	0.80	13.2	60	CGE
..	....	.....	1	4,500	Francis	270	.....	246	CAC	.....	Reconstruction project			.....	....	....	....	..	.....
..	....	.....	1	12,000	Francis	250	.....	124.5	CAC	.....	Reconstruction project			.....	....	....	....	..	.....
1	1938	.....	1	32,000	Francis	120	115	109	DEW	W	.....	.....	.....	27,500	AG	0.80	6.6	50	WEI
1	193(	.....	1	315	Impulse	720	550	525	PW	W	.....	.....	.....	.....	....	....	....	..	IGE
1	1937	.....	1	3,750	Impulse	900	.....	2,150	BS	W	.....	.....	.....	.....	....	....	....	..	WEI
..	....	.....	1	.....	Impulse	750	.....	.....	MS	.....	.....	.....	.....	2,500	HS	0.80	3.0	25	WEI

WEI —Westinghouse Electric International Co

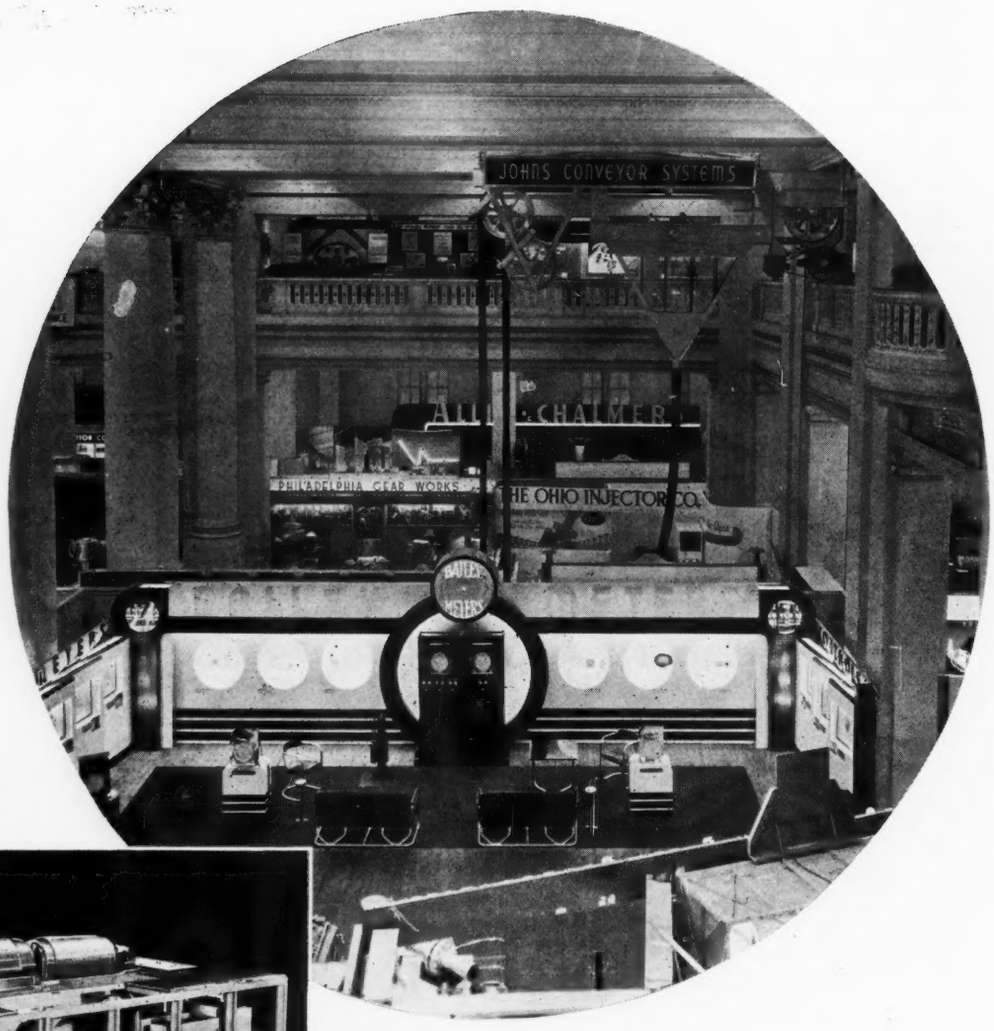
[2] The term "New" applies to entirely new projects on sites that have not been developed previously. "Redevelop" indicates a project on a site that has been developed previously and may consist of new wheels and settings or an entirely new plant. Reconstruction indicates rebuilding of old equipment.

[3] AG indicates that the thrust bearing is above the generator rotor; BG, thrust bearing located below the rotor; HS, horizontal-shaft design.

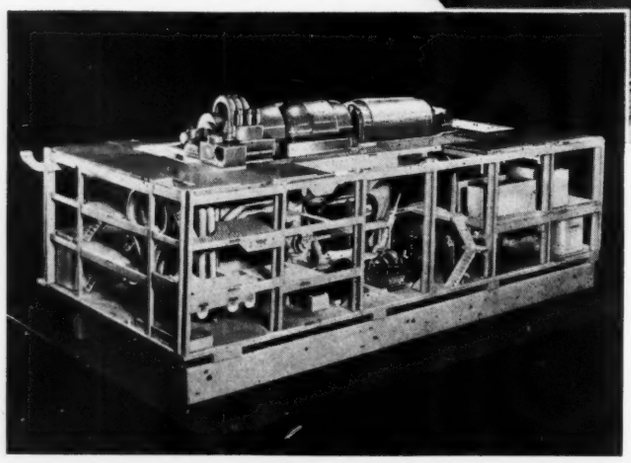
[4] GCG, gravity type with control gates; M, masonry; EF, earth fill; SH, semi hydraulic; P&G, piers and gates; REF, rolled earth fill; CG, concrete gravity; MA, multiple arch; GA, gravity arch; CAA, constant angle arch; CA, concrete arch; USN, United States navigation; RFC, rock filled timber crib; CP&SL, concrete piers and stop logs.

[5] ES, Elbow with splitter plate; EHS, elbow with horizontal splitter plate; VS, vertical steel.

[6] AAP, propeller type with automatically adjusted blades.

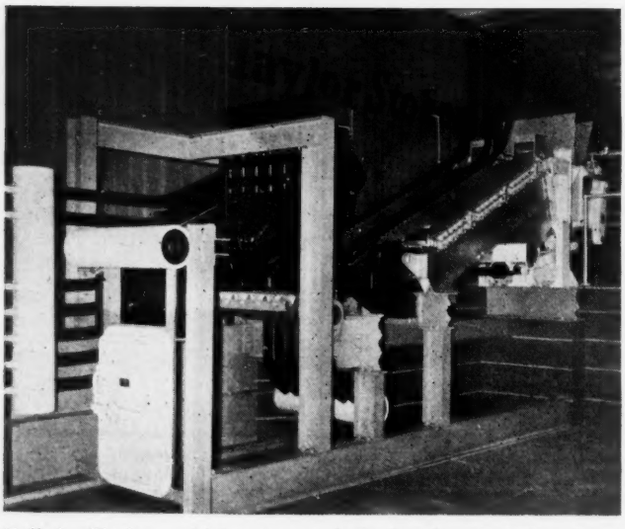


Some of the main-floor exhibits. Note full-size coal-conveying system—a snake-like rubber pipe that swoops down, divides, picks up coal, closes, and carries it vertically to discharge point

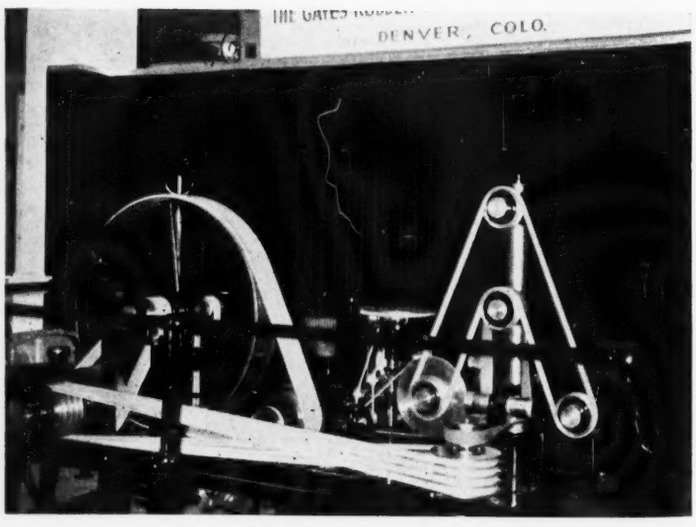


Model of the 80,000-kw turbine-generator, condenser, and auxiliaries at the Port Washington Station of the Milwaukee Ry and Light Co

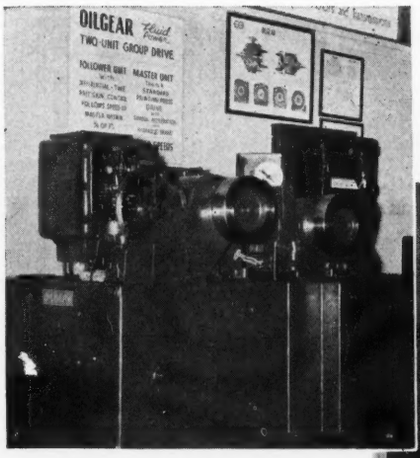
SEEN AT



Full-size Taylor multiple-retort underfeed stoker, including lower section of water-cooled side, rear and front furnace walls

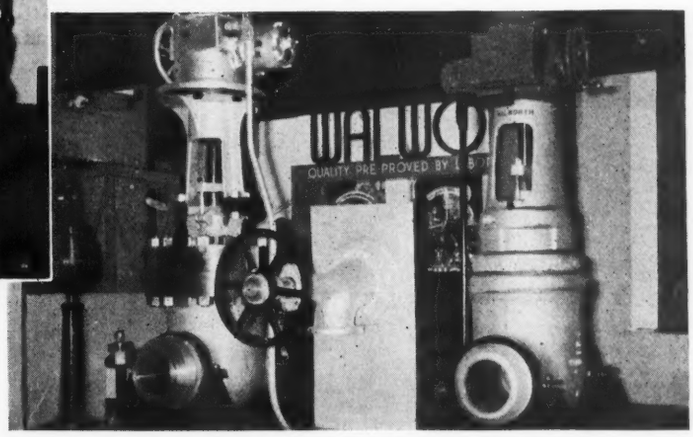


A sample of the power-transmission-equipment display, which included flat belts, pulleys, shafting and multiple V-belts

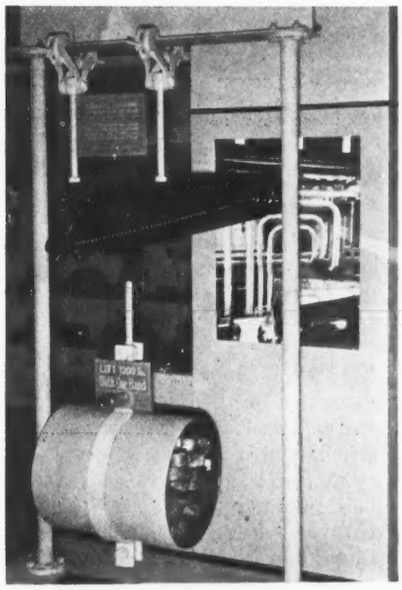


A new hydraulic variable-speed transmission that gives close regulation over a wide speed range

Power-operated, 10-in., carbon-moly valves for 1500-lb and 1000 F—one (right) has valve bonnet welded to body, other has bolted construction



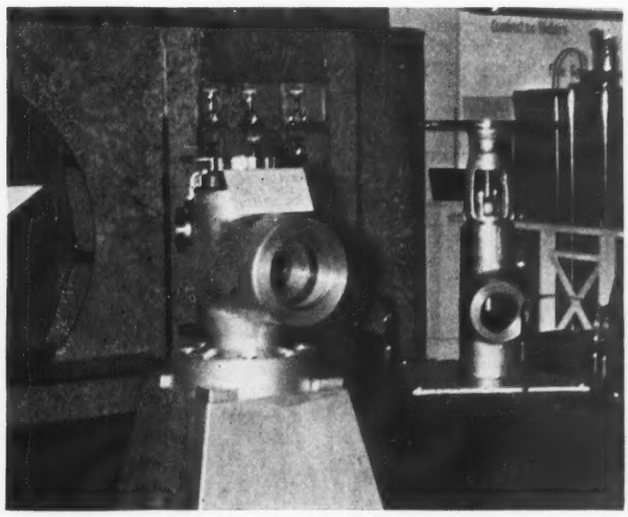
Genspring constant-support pipe hanger for a load of 1200 lb



The belief that 13 is an unlucky number got a bad jolt from the success of the Thirteenth National Exposition of Power and Mechanical Engineering held at Grand Central Palace, New York, N. Y., Dec 5 to 10. In spite of the business recession of the past year, about 300 exhibitors expressed confidence in the future by putting on one of the most interesting and instructive power-plant and power-application equipment shows ever held

THE POWER SHOW

1200-rpm, 4-cyl opposed-piston diesel (right); 175-hp, 1750-rpm, 6-cyl gasoline engine (left)



Check valve (left) and cutoff valve (right) for threaded-pipe connections on 2500-lb feedwater service

American Society of Mechanical Engineers

ANNUAL MEETING
DECEMBER 5-9, 1938

The ten pages that follow report papers and meetings of interest to power engineers

Color photography of slag formation in boiler furnaces affords a new way of bringing conditions in widely separated boilers together for study. Feedwater progress and combustion-control survey are reported

Modern Boilers, Feedwater Progress

PERHAPS the most important factor in the service availability of modern large boilers producing steam at high temperatures is the formation of slag on heating surfaces of boilers, water walls and superheaters. In presenting his paper "Modern Boiler Furnaces", E G Bailey of Babcock & Wilcox Co showed color movies of flame travel, temperature variations and slag formation in five new installations.

Several reels of film showed furnace conditions at Richmond Station, (Philadelphia), Springdale, Rivesville, West End (Cincinnati) and Essex (New Jersey. With different burner arrangements and furnace dimensions, the films brought clearly to the audience the temperature variations from burner flame to superheater. Slag formations resulting from the different coals and furnaces were correlated with data on ash characteristics of the coals.

The cooling effect of a slag screen was visible from a color change as the hot gas passed through the screen and built up slag on the cooler side of the tubes.

Superheaters of today are required to produce steam at temperatures of 900 to 950 F under close temperature control. They must absorb 25% or more of the total heat input to the unit and to do this with any reasonable amount of surface, they must receive gas at fairly high and dependable temperatures. In this, ash constitutes the major problem whether in the form of molten slag, plastic slag, sponge ash or flyash.

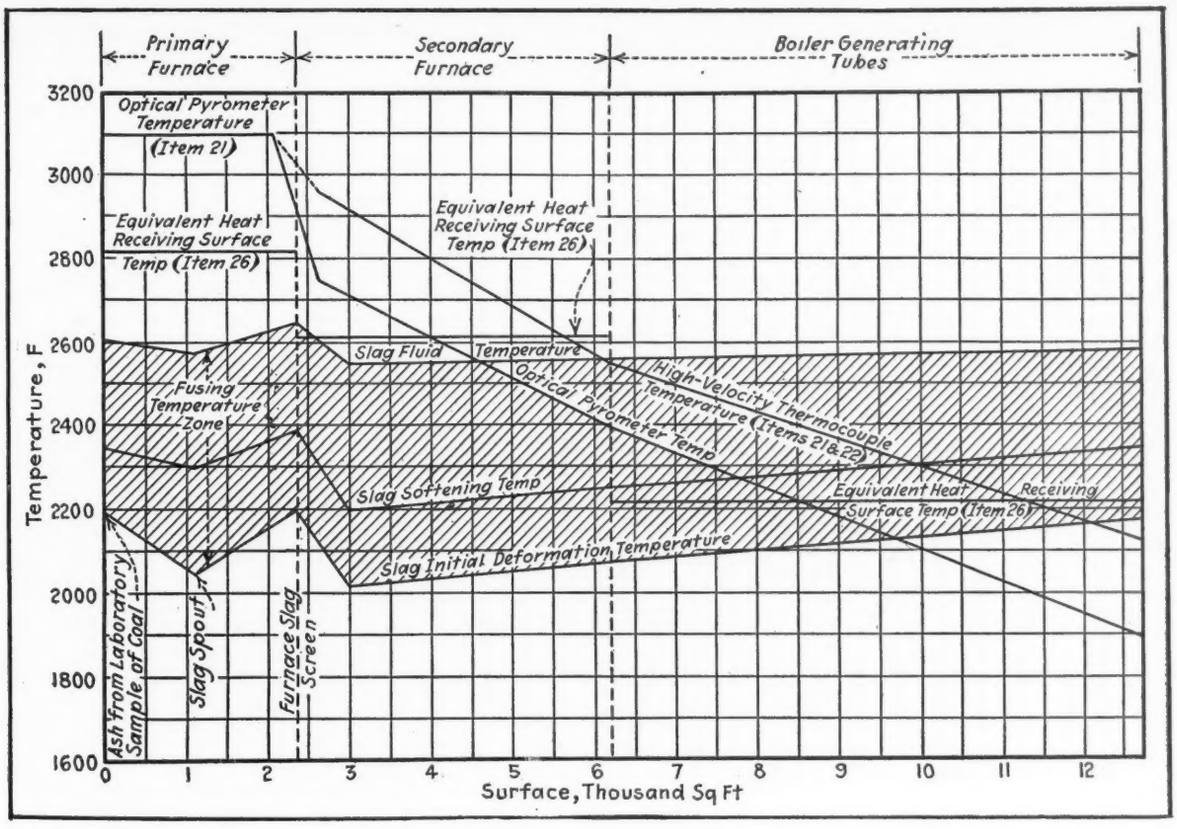
Dry ash removal from pulverized-coal-fired furnaces is satisfactorily accomplished with a wide range of fusing temperatures, using turbulent burners, and water-cooled furnaces, for outputs up to 200,000 lb per hr and for moderate steam temperatures.

All Ash Fuses

The nature of the ash in the coal, noted Mr Bailey, is of greatest importance in designing a furnace for dry-ash removal. The intense heat from turbulent burners fuses almost any ash locally within the active combustion zone. Ash pit and boiler tubes must be far enough away to allow the ash particles to cool or they will adhere to the hopper or tubes. Ash accumulations on water walls may spread and insulate the absorbing surface so that gas temperatures rise until slagging occurs farther up the boiler bank.

Equivalent heat-receiving-surface temperature is shown plotted in the graph as a straight line for each furnace zone. Calculated for given conditions, this value allows some estimate of what areas will be covered by molten slag flow. When the temperatures throughout the tube bank are within the sticky range of the ash which collects there, mechanical cleaning by telescopic deslaggers and retractable jets using steam-water mix is required.

In burning pulverized coal with turbulent burners in hot furnaces with the proper excess air, all but a small residue of the coarser coal is burned completely in the furnace and only residual ash particles remain. Microscopic examination of flyash discloses tiny spheres together with crystals of unfused ash. There are also some particles of carbon or coke from the residue of coarser coal present in the flyash. Under the microscope, these pieces of coke have on their surface beads of ash, many of which are fused into multicolored spheres. They are residue ash from surface burning of the particle. Continued slow burning



Gas-ash temperature graph

and Automatic Combustion Control

keeps the temperature of the particle above that of the carrying gas and makes it more likely to stick to wall or tubes. Breaking off of the small spheres accounts for the fineness of flyash, each coal particle breaking up into ash bits.

In conclusion, Mr Bailey summarized that fusing temperature determinations for ash are not accurately indicative of slag formation, that some ash or slag adherence occurs on all heating surfaces, and that some ash and slag have a wide spread in temperature between the initial softening point and fluidity.

In commenting on the paper, E L Hopping, Philadelphia Electric Co, stated that the boiler manufacturer is in a better position to attack the slagging problem than the customer and that Mr Bailey's paper represents an excellent piece of research in connection with this most serious problem. Mr J F Muir indicated that large-boiler users could afford to pay considerably more for superheaters with wide spacing on the basis of better service-availability records. He noted that within an elapsed time of about one second, a particle of coal had to burn, fuse ash, cool off and leave the tube bank, in the modern furnace. Perhaps, he added, a radiant section of superheater surface will be the answer.

J M Drabelle, Iowa Electric Light and Power Co, reported that he had been studying the action of stoker fires with colored motion pictures and that the quite simple procedure could be carried out by anyone with a similar problem to study.

Feedwater Treatment

C H Fellowes, Detroit Edison Co, reported briefly on the status of the work of the Joint Research Committee on Boiler Feedwater Studies. He indicated that sodium sulphate in the proportions directed by the ASME ratio has in some instances been found ineffectual in preventing caustic embrittlement and that lignins had been found suitable in certain instances up to temperatures of 550 F.

One of the first American applications of complete automatic combustion control was that initiated in 1924 at the Sherman Creek plant of Consolidated Edison Co, New York. In all, 44 stoker-fired boilers (about 50,000 lb per hr each) were so equipped.

In the Hell Gate Station of the same company, 20 boilers (165,000 to 800,000 lb per hr) were equipped with combustion control in the period from 1924 to 1930. The Hell Gate units include both stoker-fired and mill-fired boilers and a variety of fan drives.

The control applied regulates air flow and, in many cases, coal flow. In general, draft fans and stack dampers have individual regulators. Coal flow is regulated by speed of mill feeders or stokers. Reeves drive is used at Sherman Creek and Ward Leonard at Hell Gate.

This, and much additional information regarding these pioneer combustion control installations, were included in a paper by P W Keppler of Consolidated Edison. Using the operating characteristics of these systems as a starting point Mr Keppler made a fundamental analysis of the control process, using differential equations in its development and to state his conclusions. These equations, with suitable constants for the specific application, can be used to determine characteristics of control systems installed in other plants.

Fighting Corrosion on Two Fronts

A report of high-temperature steam experience at Detroit with the 1000-F turbine at Delray and the 1100-F superheater at Trenton Channel. Corrosion fatigue of boiler drum at Boston is an unusual case that points to need for frequent and thorough inspection of boilers

COMPLETING the report of experience with the 10,000-kw, 1000-F turbine at Delray Station of The Detroit Edison Co, R M VanDuzer and Arthur McCutchan presented a paper concluding that 1000 F temperature is feasible when and if it can be economically justified. The paper, a continuation of the progress report of December, 1933, covers the experience with the 1100-F superheater at Trenton Channel as well as the high-temperature turbine.

The Delray turbine was dismantled early in 1937, it being felt that experience had proved the practicability of 1000-F steam. Now rebuilt to use available 815-lb, 900-F steam and to exhaust into the existing 400-lb, 700-F system, it had operated 23,000 hours with steam at 1000 F.

The experimental 1100-F superheater installation at Trenton Channel was also discussed by the authors. The object of this installation was to determine corrosion effects of steam and to obtain creep information on pipe as a check on laboratory information. Two groups of nine different steels were each subjected to the high temperature steam. Examination showed that (1) early scale layers materially inhibit subsequent attack by the steam and that (2) increased silicon content of chrome-molybdenum alloys does not increase resistance to steam corrosion as had been expected from laboratory air-corrosion tests. In what respect the processes of air and steam corrosion differ is not known.

Field Check on Creep

Creep of pipe under internal pressure has been studied by machining alloy tubing down to thin wall sections to produce high stress with 380-lb steam pressure. These were exposed at 1100 and 925 F and the diametral creep rate measured for comparison with laboratory data obtained from the University of Michigan. Results are in reasonably close agreement with those expected from the laboratory data.

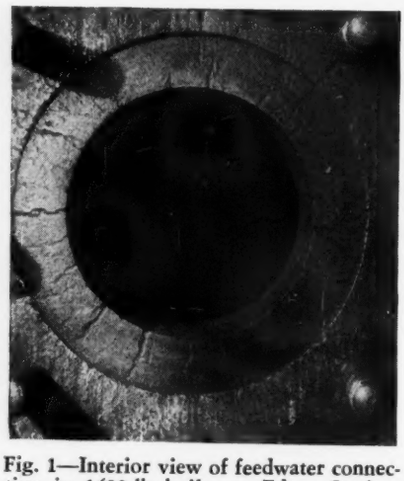


Fig. 1—Interior view of feedwater connection in 1400-lb boiler at Edgar Station, showing cracked drum metal

Dr A E White of the University of Michigan noted that a corrosion test in steam or air is not the sole criterion, that another factor might be termed "stress corrosion" which proceeded to failure without actual elongation. Starting with a ductile metal, he added, one might end up, after exposure to high temperatures, with a material that would fail, if subjected to shock, without bulges or warning cracks.

The power industry, and the public too, said Mr G B Warren of General Electric Co, are indebted to the utility companies for improvements in power generation made possible only by their willingness to advance in fields where engineering data is scant. The laboratory of the large equipment builders, he concluded, must still be in the plants of their customers.

In the second paper of the session, Dr A E White, of the University of Michigan, gave results of an investigation of cracks found in the drum and connections of one of the first high-pressure boilers in this country at Edgar Station of Boston Edison Co. The boiler had operated almost continuously since 1927, a total of 60,000 hr. Cracks were found in the walls of the boiler drum (which formed a part of the feedwater inlets), in the lower connections of the water columns, and in the forged-steel tee fittings at the inlet and outlet of the superheater.

Feedwater enters through a forged steel nozzle attached to the forged drum by stud bolts, and passes through a hole in the drum to the internal feedwater distributing pipe, which is in turn fastened to the inside of the drum by stud bolts. This results in the bore of the drum becoming part of the channel through which the feedwater enters. The major cracks were found in the face of this bore.

The nature of the cracks precluded their being due to caustic embrittlement, and while corrosion was a factor, they did not have exactly the appearance of corrosion cracks. The cracks were determined to have resulted from accelerated corrosion accompanied by repeated stress.

The cause was found in boiler operation, feedwater temperature varying from 250-F (minimum for normal operation) to 587 F when the flow completely shut off due to the operation of the regulator. The surface of the drum bore was thus subjected to repeated temperature change with resultant rapidly changing stress conditions. A change in design of feedwater inlet eliminated contact of cold feedwater and boiler-drum metal by an internal tube spaced away from the drum metal. Cracks in other locations were of a similar nature. In every case, cracks were ground away and steps taken to prevent recurrence. It was not felt that any of the difficulty could be attributed to faulty metal.

After the changes, reported J B Roemer of the Babcock & Wilcox Co, the variation in temperature of the drum metal is less than 15 F. M D Engle, Boston Edison Co, added that in rebuilding another similar boiler, more metal had been removed to erase the cracks but that the drum strength was not impaired.

Dean Hollister, Cornell University, presented results of laboratory testing of tubes with unreinforced openings.

Fig. 2—Exterior view of drum metal with stud bolts for attaching feed-pipe forging

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URNS AND KETTLES—C-H Immersion Heaters are used in hundreds of applications from stills and sterilizers to restaurant equipment and industrial kettles.

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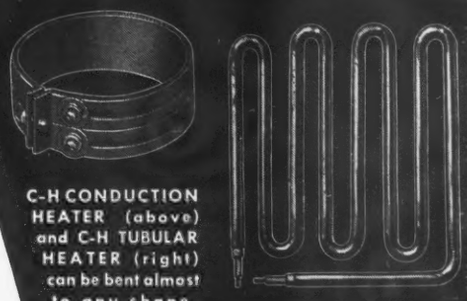

C-H CONDUCTION HEATER (above) and C-H TUBULAR HEATER (right) can be bent almost to any shape, used wherever controlled heat is required.

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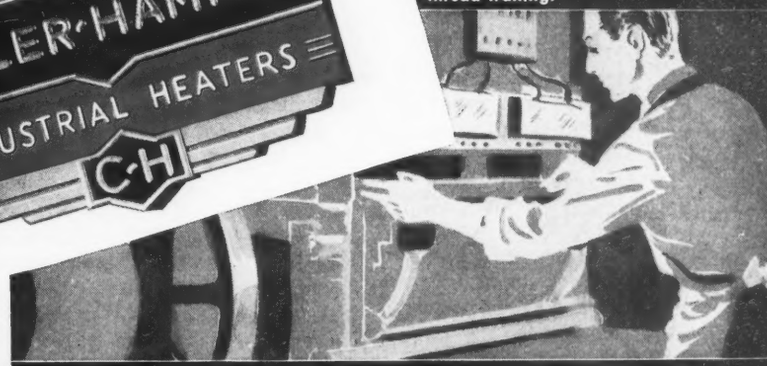

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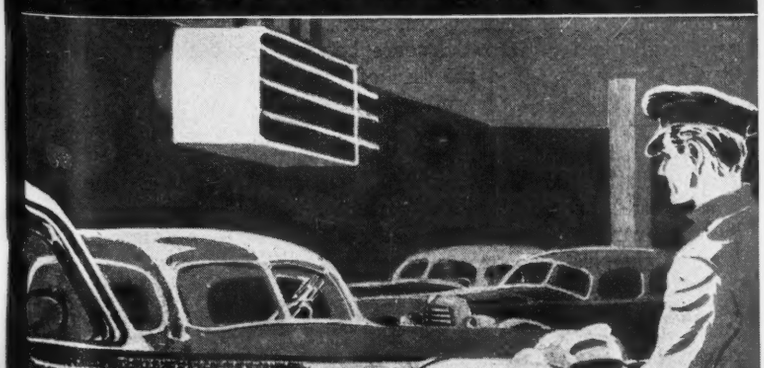

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C W E Clarke

Power for Industry on Land and Sea

Industrial power plants grow larger, more complex and more efficient, and marine power plant practice starts to catch up with stationary—two outstanding papers tell the story

PROVIDING suitable electric generating facilities for industrial use requires analysis of many factors such as type of load, source of water and fuel supply, condition of existing equipment, future growth, possible steam pressures and temperatures, interconnections, and numerous other local items, according to Charles W E Clarke, consulting engineer, United Engineers and Constructors Inc, who presented a comprehensive survey of modern industrial power practice.

In general, it is safe to say that where there is a moderate demand for process steam, it pays to generate power up to steam requirements, but where there is no need for process steam, it is not usually wise to install condensing units when good utility service is available. In many cases, industrial power plants and utilities can combine forces and operate plants in conjunction.

A wide variety of turbines is available to meet special industrial load conditions, running at 3600 rpm in most cases. Although some plants operate under higher conditions, 900 lb and 850 F seem to be the sensible limits for industrial plants. For even lower steam conditions, the superposed turbine offers an excellent means of modernization, salvaging much obsolete equipment and greatly reducing overall heat rate. Many plants now operating at 200-lb can take advantage of this without exceeding 600-lb pressure. Quoting POWER'S Mid-September 1937 tabulation of 117 new steam turbine installations, Mr Clarke pointed out that only 5 units were designed for 1200 lb, and only 15 for 700-900 lb, with the biggest single group (58) in the 400-500 lb class.

Remarking on the trend to larger units, the speaker gave figures showing the effect of size on price of turbine-generators and boilers. Encouraging this trend to larger units has been the increase in availability of boilers, now nearly equal to that of turbines.

Discussing steam cycles, Mr Clarke pointed out that three major cycles may be noted: (1) new high-pressure boilers supplying new backpressure turbine equipment exhausting to low-pressure equipment also fed by old l-p boilers, (2) a similar arrangement, but with extraction steam feeding low-pressure equipment in conjunction with old boilers, and with turbine exhaust going to low-pressure process, and (3) new h-p boiler supplying a condensing extraction turbine, with steam from the upper extraction point going to existing low-pressure equipment also supplied by old boilers, and with steam from the lower extraction point going to low-pressure process.

Acceptance of high pressures in industrial plants has made reducing and desuperheating equipment indispensable. Recent rapid development in this field has increased speed of response and availability, and produced equipment capable of more accurate regulation. An equally important advance is in the ability to control extremely high quantities of steam.

The modern steam generator bears little resemblance to the old-time boiler; waterwalls, economizers, air heaters, superheaters and occasionally reheaters, are modern features. Lack of water storage is compensated for by high steaming ability fortified by quick-acting feedwater regulation and automatic combustion control.

Parallel with development of the boiler has been improvement in the art of feedwater conditioning. Higher pressures and temperatures complicate the problem, giving rise to complex scale formation and accelerated corrosion. Raw waters vary widely, but means have been found to condition most of them satisfactorily if proper study is made.

Most widely used industrial plant fuel is bituminous coal, with oil and gas finding application where local conditions are favorable. Many unusual fuels are used in industrial plants, including anthracite culm, lignite, blast-furnace gas, petroleum coke breeze, acid sludge, and various industrial waste products. Examples of each type of firing were given by Mr Clarke, who also described furnaces for recovering valuable sodium compounds from black liquor in the kraft-paper industry.

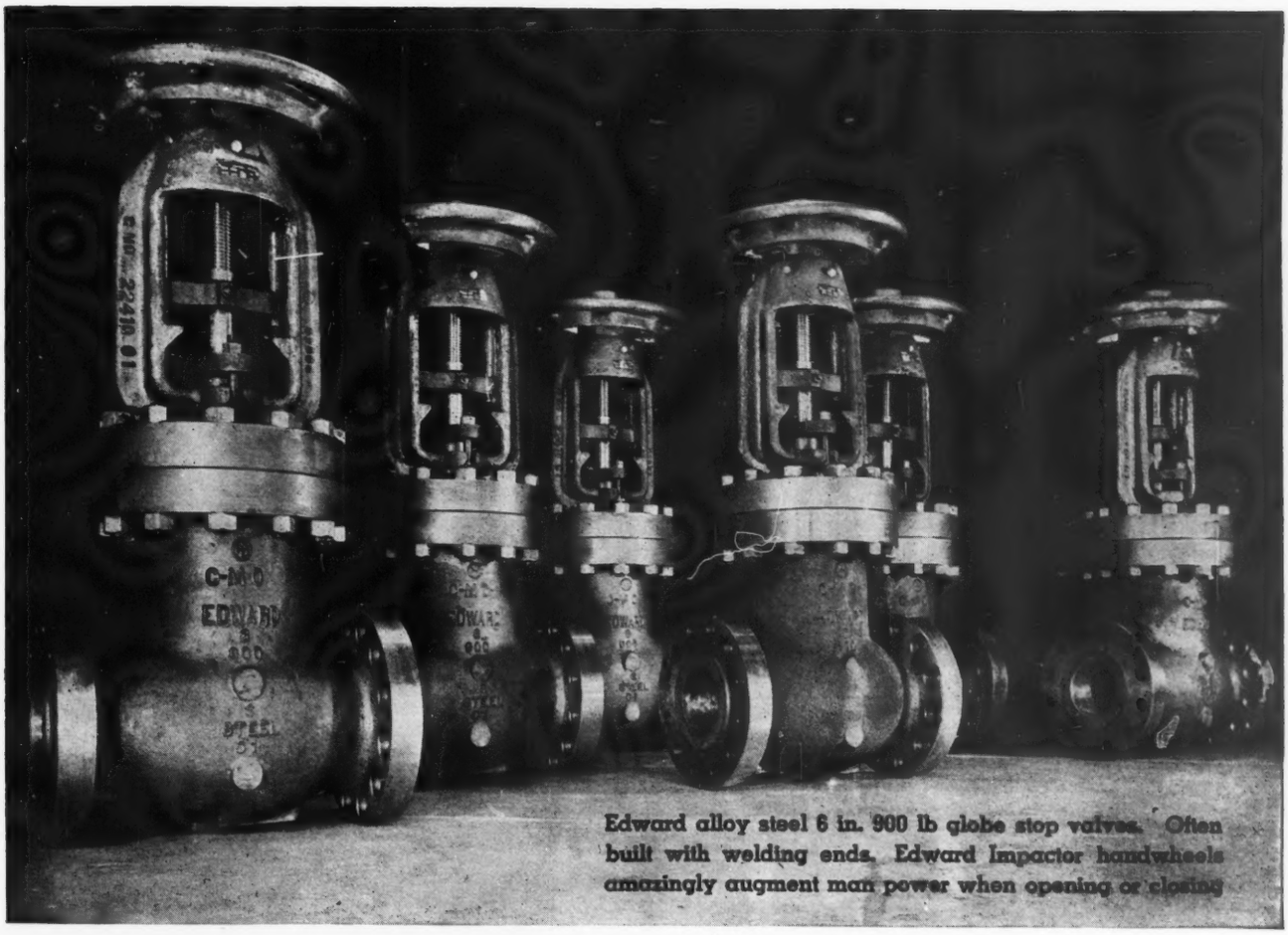
Concluding his comprehensive survey of the industrial power field, Mr Clarke pointed out that one indispensable item of engineering in this field is return on the money invested, which must be in the neighborhood of 25% (gross) before making an expenditure based solely on economy.

Seagoing Power Plant

An unusually complete description of engineering studies, equipment installed and test results was presented by Lester M Goldsmith, chief engineer, the Atlantic Refining Co, who told of the turbine-electric tanker "J W Van Dyke," highest-pressure steamship in the U S merchant marine.

Careful hull and propeller tests on models were the basis for setting the horsepower requirements of this ship. Turbine-electric drive was selected as giving the lowest over-all operating cost and permitting unusually rapid discharge of cargo by motor-driven pumps in an amidships pump room. Applying principles used in designing land power plants, a careful heat balance was first laid out, with three stages of bleed heating and arranged for minimum makeup. Two 22,500-lb-per-hr boilers, operating at 625 lb and 835 F, are straight-tube units without internal baffles, equipped with air heaters but without economizers. Automatic combustion control has produced excellent results.

Another interesting feature is the method of avoiding entrained air in sea water taken in for circulation through condensers. Water is brought into the space between the tank top and the skin of the ship, and baffles and vents separate and remove entrained air before it reaches intakes of the circulators at the bottom of this chamber. Air removal seems effective, as examination after 6-months operation disclosed no sign of pitting on tubes or corrosion of impellers.



Edward alloy steel 6 in. 900 lb globe stop valves. Often built with welding ends. Edward Impactor handwheels amazingly augment man power when opening or closing

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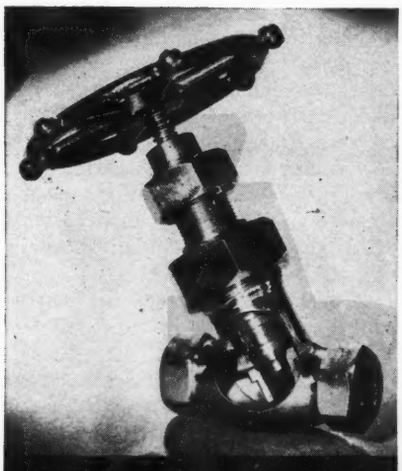

Edward straightway forged steel globe valves, better year by year, deserve a place in every plant. Order Fig. 2688 (above) and other out-of-stock Edward valves from Better Valves Catalog No. 101. Ask for copy.

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IF you want to stop flow in a pipe, no valve equals a globe — or angle – stop valve in efficacy. It can cope with high temperatures and high pressures. It is first choice for throttling. And if leaks should develop – due to stray foreign matter, abuse, erosion, corrosion, improper service or old age – repairs may be made more cheaply and quickly than with other types of valves.

Built into Edward globe and angle stop valves are the results of three decades of intensive study of such vexing problems as are related to non-return, blow-off, and boiler feedline stop-check valves in which Edward has always specialized. Internal contours promote free flow without undue turbulence and cross currents. Carefully selected, painstakingly tested, and accurately machined materials prolong life. Keen inspection is maintained to catch mistakes. Design details are frequently revised to keep pace with new developments. Disks are positively guided by integral body ribs, self scouring, non-clogging, and assuring accurate seating.

For ease of operation, the Edward Impactor handwheels shown on the 6 in. 900 lb valves (above), or the super size knobbed handwheels on the forged steel valve (left) make friends with operators, save time and money, and improve plant appearance.

EDWARD VALVES

Oil and Gas Power Progress

WITH TOTAL installed horsepower doubled and the field of application extended enormously, oil and gas power has forged ahead in the past five years according to Howard E Degler, University of Texas. In a highly condensed form he outlined principal developments in this 5-year period.

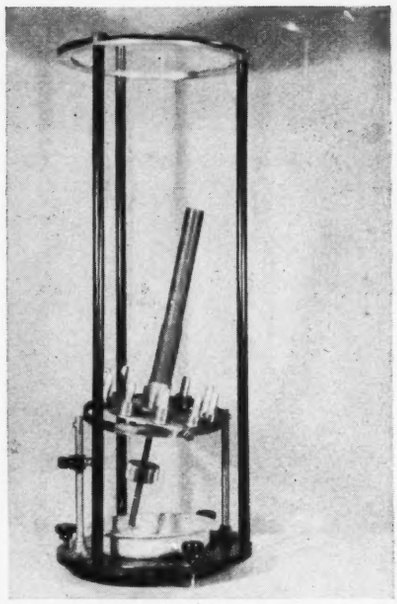
Major diesel design trends include higher speeds, weight reduction, increased unit output, increased use of supercharging, more compactness, greater use of small engines, more gas-diesel units, welded frames and other parts, and more complete enclosures. Other developments comprise higher mean effective pressures, increased use of waste heat, combination of diesels and steam plants for improved heat balance, automatic control, and better governing.

Biggest future for the diesel may be in small units widely adaptable for application in portable industrial service, long-haul truck and bus transportation, light-weight, high-speed trains, in the marine field, and even in aviation. Many high-speed diesels now compare favorably with gasoline engines in power, speed, size, weight, ease of starting, performance, and reliability. New bearing materials and advances in refining and compounding lubricating oils contribute to this development. At higher speeds, the principle design problem is the combustion system, and various designs of auxiliary combustion chambers have been evolved to produce the turbulence required for clean combustion and good fuel consumption.

During the five years covered in Mr Degler's review, the gas engine has made a real comeback, taking advantage of the extension of pipelines. Design changes have made the vertical multi-cylinder engine typical, and like the diesel, speeds are higher. New fuels include sewage sludge gas and butane. Increased use of gas was followed by development of convertible engines equipped to burn either gas or oil with only small changes, and the so called "gas diesel" which burns gas on the compression-ignition cycle.

Summing up, Professor Degler said that the past 5-year period has been devoted to lowering engine weight, decreasing bulk, increasing performance, lowering installed costs per horsepower, and bettering performance.

Aimed at the rapid solution of diesel-engine vibration problems involving vector analysis, the "Vectorscope" adds vectors and shows directly the size and direction of the resultant, according to George J Dashefsky of the U S Navy Yard, New York, who described the operation of this instrument and demonstrated its performance. Referring to the picture, weights proportional to the forces involved are added to pegs on the pivoted disk. The position of the disk after weights have been added is indicated on a calibrated screen by a spot of light from a flashlight-battery-operated light-projecting system in the tube rising from the disk. The location of the spot of light on the calibrated scale gives a direct reading of the size and direction of the resultant force. Mr Dashefsky's paper included a discussion of the theory of the instrument, and of its application to several design problems.



This ingenious instrument adds vectors, simplifying many diesel design problems

Lubrication Problems

TWO PAPERS were presented under the auspices of the ASME Special Research Committee on Lubrication. Walter Claypoole, in discussing "Thin Oil Films", described a method of depositing very thin oil films, about one ten-millionth of an inch thick, on polished metal in experiments on boundary friction.

Mr Claypoole reached the conclusion that the much discussed property of a lubricant loosely termed "oiliness" is of considerable importance. It is a phenomenon, however, which becomes strongly evident only when the oil film separating rubbing surfaces is exceedingly thin, probably on the order of molecular dimensions. Oiliness has no effect whatever on friction losses in viscous-film lubrication. Conversely, in films of molecular dimensions, viscosity is a negligible factor, while oiliness is very important.

It is generally accepted that the coefficient of static friction of a pair of metals on a thin oil film is greater than the coefficient of running friction. Mr Claypoole's experiments show, however, that this belief is subject to radical modification, particularly when the running speed between two surfaces is slow. In the machine used for this investigation, running speed was quite slow, being about 1.5 fpm.

In one set of tests, the rubbing surfaces were a steel disk with a tungsten-carbide button resting on it. In other tests, a bronze disk and a tungsten-carbide button were used. Seven oils of widely different types were tested, and in only one case was the static coefficient of friction higher than the running coefficient. Mr Claypoole expressed the opinion that the most useful deduction that might be made from these tests is: oiliness value of a lubricant can best be determined from the static, rather than from the running coefficient of friction.

Boundary or semi-fluid friction takes place in bearings of almost all rotating machines when they are started or brought to a standstill. This type of friction, lasting a short time, usually wears the bearing or journal surface or both. Wear takes place also in the case of anti-friction bearings because of sliding, rolling, or a combination of both.

L M Tichvinsky, in "Wear in Lubricating Problems", described methods employed to obtain the wear resistance of various metals, especially those used in bearings. A study of wear resistance of three case-hardened steels was made to determine the most suitable heat treatment for crankshafts. Results revealed that the material which received nitrided heat treatment had a much higher resistance than the same material heat treated by other methods.

DO YOU KNOW?

THE NALCO QUESTION BOX

How should an engineer go about making a rapid check test of hardness in boiler feedwater?

(See Bulletin 6A)

THE NALCO QUESTION BOX

What simple method is available to reduce the dosage of alum required to clarify water used in beverages, swimming pools, ice plants, etc.?

(See Bulletin 29)

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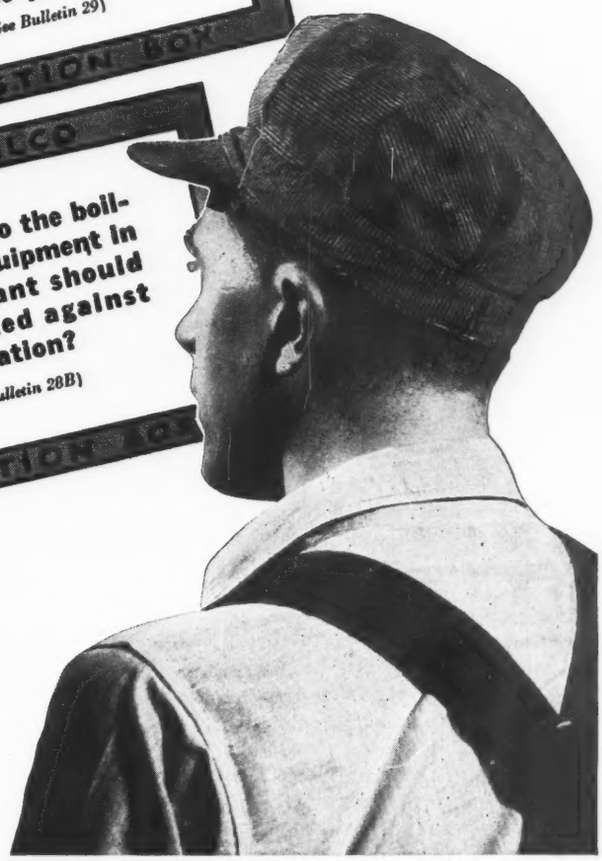
How can an engineer increase the efficiency of an existing Lime and Soda Ash Softening Plant?

(See Bulletin "Nalco System for Softening Plants.")

THE NALCO QUESTION BOX

In addition to the boilers, what equipment in a power plant should be protected against scale formation?

(See Bulletin 28B)



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Meters and Instruments

The goal is higher accuracy and greater reliability — nine papers point the way

THE PROBLEMS of meter accuracy and reliability were emphasized at the fluid-meters, hydraulic and industrial-instruments session at which nine papers were presented. One of the most practical was "Influence of Steam-Flow Metering Equipment on Piping Design," by R M Van Duzer, Jr. This paper is based on The Detroit Edison Co's experience in remodeling Connors Creek and Delray steam plants. Mr. Van Duzer pointed out that steam-flow measurements in modern power plants are often neglected in the initial stages of design. Proper consideration of this question by the piping designer and meter expert in the early stage of piping study can nearly always result in a better and more economic installation.

The use of stream-flow measurement instead of water weight for acceptance testing is a result of better understanding of the various factors influencing accuracy. Two of these factors are directly related to piping design. The first is the nozzle or orifice-plate throat diameter, D_2 divided by the inside pipe diameter D_1, see illustration.

Orifice Location

The second of these factors is nozzle or orifice plate location in the pipe to permit satisfactory upstream and downstream flow conditions. Several typical nozzle locations with different piping arrangements are shown in the figure. The values given are those which have been established by experiment to give dependable flow coefficients and are the best available at the present time. Whenever there is doubt as to whether undisturbed flow is obtained, use of a straightening vane in addition to the minimum length of straight pipe is advisable. This is particularly true where the primary element is preceded by bends in more than one plane. It is difficult even with long lengths of straight pipe to eliminate the double swirls set up.

Experiments made at the Alden hydraulic laboratory of the Worcester Polytechnic Institute, to find out the reason for variation of the coefficient of pitot tubes were presented in a paper "Investigations of Errors of Pitot Tubes," by C W Hubbard. Tests made in still water showed that the impact orifice of the pitot tube registers the true dynamic head within one part in a thousand.

The conclusion drawn from these tests is that the most reliable pitot tube is one of the combined type using a tip-pressure piezometer. This piezometer or group of piezometers should be located on the tip at a point where the rod effect is stable and affects all piezometers in the group about the same amount. Such an instrument may not read the true velocity head, but its error will be constant for all ordinary velocities and sizes of pipe, so that it is capable of being calibrated and used under different conditions of flow.

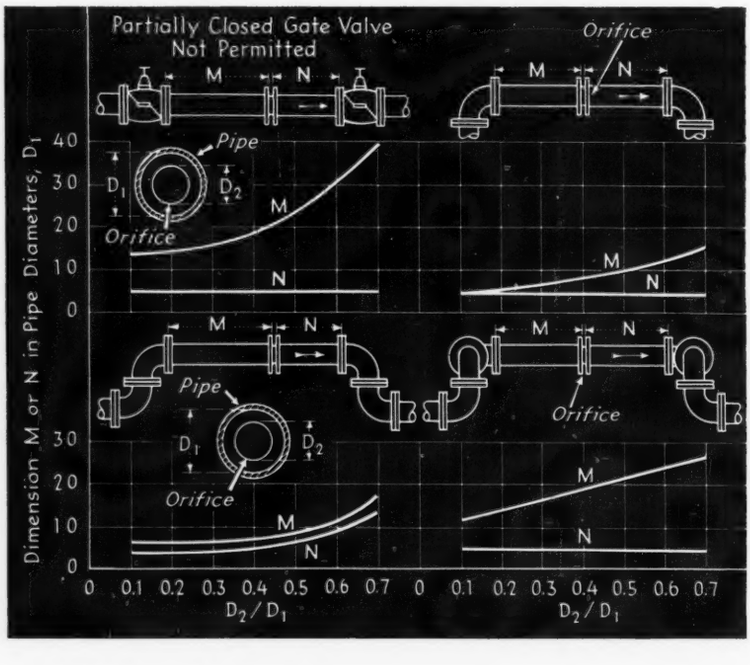
Comparative calibration with two different types of pitometers which react differently to angular flow, indicates the absence of angularity effects in large pipe, according to Edward S Cole and E Shaw Cole in their paper "Pitot Tubes in Large Pipes." To check this, the authors made measurements in two large pipes and found the angularity to be less than 3 deg. The conclusion is that where stable flow exists at the gaging section, pitometer measurements of discharge can be made with a high degree of accuracy in large pipes.

A paper by R G Folson presented a summary of investigations made at the hydraulic laboratories of the University of California in cooperation with the ASME Special Research Committee on Fluid Meters, to determine nozzle coefficients for free and submerged discharge. W S Pardoe in a paper "Effect of High Temperatures and Pressures on Cast-Steel Venturi Tubes" explained results of tests made at the University of Pennsylvania to determine the effects of expansion in the main and throat diameters of cast-steel venturi tubes under dry heat and pressure, respectively, and the comparative effects of high temperatures and pressures.

"The Effect of Pulsation on Orifice Meters," by S R Beitler, described three test set-ups made for investigating the effect of pulsation on orifice meters for the measurement of gas. An analysis of the weakness of three methods of air-velocity measurement, namely, hot-wire anemometer, Thomas or Callandar meter, and nozzles, orifices or pitot tubes used with liquid manometers, was presented by Neil P Bailey in "Pulsating Air-Velocity Measurement."

Other papers presented were "Review of Flow Nozzle Research with Oil" by E E Ambrosius and "Quantitative Analyses of Single-Capacity Processes," by A F Spitzglass.

Minimum length of straight pipe for undisturbed flow without straighteners. (For nozzle orifice-plate installations. D_1-inside pipe diameter, D_2-diameter of throat of nozzle or orifice plate. From ASME "Instruments and Apparatus," Part 5, Chapter 4. Based on Figs. 1 to 5, Report of the Joint AGA-ASME Committee on Orifice Coefficients, 1935; and Figs. 27, 27-a, 28 and 29, "Durchflusszahlen von Dusen und Staurandern," by R Witte, *Technische Mechanik und Thermodynamik,* vol 1, March 1930, page 113)



PARTIAL LIST OF ORDERS RECEIVED

FOR THE NEW COPES FLOWMATIC REGULATOR

USER AND LOCATION	DATE	NO.	MAKE	BOILER DATA WSP LB.	BOILER DATA MAX. EVAP. LB./HR.
Canadian steel mill....				130	
Canadian steel mil...		1	B & W		
Connecticut...	1937	2			
Illi...nt.....19...					90,000
...ant.....				650	70,...
M... ...xtile mil...				450	...
Mic...gan chemica...		1	F-W		
Michigan paper mil...	1937				
Michigan rubber company.....	1937				20,000
Mic...igan utility plant.....	1937		W	850	40...
Michi...an utility plant.....	1938	1	F-W	875	
Missouri utility plant.....	1938	1	B & W	225	1...
	and 1938	2	W & W	180	110,000
Nebraska utility plant.....	1937	3	B & W	400	140,000

*Two COPES Flowmatic Regulators purchased for each boiler.

USER AND LOCATION	DATE	NO.	MAKE	BOILER DATA WSP LB.	BOILER DATA MAX. EVAP. LB./HR.
...D LOCATION					
...utility pl...	1938	2	C-E	475	200,000
...Jersey in... ...ant...	1938	1*	C-E	400	50,000
New Yo...	1938	1	C-E	410	75,000
...plant....	1...	1	...den.	650	100,000
...il.....			W	415	3...
...extile mill			Vogt		
...ennsylvani...	1938	1	W		
Penn...	1937				...,000
...l mill...				400	85,000
...a utility ...			B & W	675	200,000
...sylvania ut...		1	F-W	875	400,000
Texas che...	1937	1	B & W	400	200,000
Texas	1937	1*	Riley	600	350,000
Virginia ... mill.....	1938	2	B & W	450	120,000

Name of any user listed above will be furnished on request.

ANOTHER ORDER -- Connecticut utility selects COPES Flowmatic for new Babcock & Wilcox Integral Furnace Boiler, 675 pounds pressure, 150,000 pounds per hour. Gibbs & Hill, Engineers.

ANOTHER ORDER -- Combustion Engineering Company orders COPES Flowmatics for two 440-pound Type VA-1 Boilers for new North Carolina paper mill. J. E. Sirrine & Company are engineers.

REPEAT ORDER -- After using a COPES Flowmatic for 600-pound Pennsylvania paper mill repeats with Flowmatic for 600-pound Springfield boiler. Evaporation, 100,000 pounds per hour.

ANOTHER ORDER -- Illinois coal mining company orders a COPES Flowmatic for a 120-pound pressure Edge Moor boiler handling mine hoist loads. Peak evaporation, 60,000 pounds per hour.

ANOTHER ORDER -- Pennsylvania steel mill selects COPES Flowmatic for three 250-pound Erie City Iron Works boilers fired with stokers and blast furnace gas. 150,000 pounds per hour.

Why this trend to the new Flowmatic?

There are good reasons why the trend in modern plants is definitely to the new COPES Flowmatic for effective feed water regulation. Closer boiler water level control on the most rapidly swinging loads. Trouble free operation with only routine attention. Simple adjustment. Easy installation. All add up to safer, more economical operation of fast steaming generators. To be sure of these benefits, specify the COPES Flowmatic. Write, on your letterhead, for descriptive Bulletin 409-A.

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Fuel Beds and Flyash

New test data promises to upset old ideas about action of fuel beds on underfeed stokers—results of 10-year investigation show possible uses for flyash

EXACTLY what happens in the fuel bed of an underfeed stoker has long been a matter of conjecture, but tests now being carried out at Hell Gate Station (Consolidated Edison Co of N. Y., Inc) seem likely to go a long way toward clearing up the mystery. A preliminary report of this jointly-sponsored investigation was presented by M A Mayers of Carnegie Institute's Coal Research Laboratory. Co-authors of the paper were W H Dargan, Joseph Gershberg, and B C Dalway of Consolidated Edison Co; E R Kaiser, Battelle Memorial Institute; and M J Williams, Pittsburgh Coal Co.

Tests were made on Hell Gate's No. 73 boiler, a 12,560-sq-ft, 165-000-lb-per-hr unit with water-cooled furnace. The stoker is 14 retorts wide with five secondary rams in each retort. Originally there were 37 tuyeres but replacement with thin tuyere blocks brought the number up to 49. All secondary rams in each retort and extension grate sections move together.

Unique testing methods were needed to study the fuel bed of this stoker. Specially designed probes, which were pushed into the fuel bed at selected locations and for various depths, carried thermocouple leads and a gas sampling tube. Measurements with the probes were coordinated with readings of boiler instruments and with coal sampling.

Items measured included temperature, oxygen and CO_2 concentration, combustible gas, and pressure differentials. For each item, series of readings were plotted to give contour lines showing the nature of the different parts of the fuel bed. Preliminary conclusions, based on this data, indicated that on this stoker at least, the mechanism of underfeed burning differs from previously held ideas.

Part of the investigation involved making moving pictures, in black-and-white and color, of the fuel bed. Mr Dargan told how these were taken and described the apparatus. The moving-picture camera was fitted with a water-cooled optical tube containing quartz windows and lenses necessary to transmit the image to the camera. No attempt was made at magnification in the optical system. Use of the tube permitted sticking the camera lens into the furnace through relatively small openings and without damage to the optical equipment.

Utilizing Flyash

For the past ten years, the Detroit Edison Co has been seeking a market for the quantity disposal of flyash collected at its Trenton Channel plant. Early in the investigation, according to a paper by A W Thorson and J S Nelles, it was determined that this market must be a local one and that the building materials industry appeared to be the most attractive.

The most promising results from the standpoint of quantity disposal have been achieved (1) in Cottrell block where flyash constitutes 90% of the dry mix, (2) in flyash-cinder concrete, replacing sand, (3) in pebble concrete as an admixture replacing up to 20% of the Portland cement, and (4) in asphalt paving, as a filler.

Continuous disposal may not be provided by the building industry because of its dependence on the seasons and on the business cycle. However, Cottrell block, and the flyash itself when dampened, can be stored if necessary.

SUMMARY OF INVESTIGATION — POSSIBLE USES FOR FLYASH

Product	*Use*	*Material replaced*	*Cost of material replaced, $ per ton*	*Type of investigation*[a]	*Extent of investigation*[b]	*Results*[c]	*Remarks*
1 Sheet asphalt	Filler	Limestone or silica dust	3.00	L & F	T	E	Local plants unsuited to fine material
2 Sheet asphalt	Filler	Portland cement	7.50	F	T	E	Small quantity used
3 Fertilizer	Filler	Foundry sand	Cartage	L	P	..	Replaced material too cheap
4 Rubber	Filler	Fuller's earth	8.00–12.00	P	P	P	Too coarse and gritty
5 Primer paint	Filler	Calcium carbonate	20.00	L & P	P	G	Small local market
6 Putty	Filler	Calcium carbonate	20.00	L	P	G	Small local market
7 Roofing material	Filler	Limestone or silica dust	3.00	..	..	..	No local market
8 Common brick	Filler	Clay	0.25–0.50	P	T	P	Weak structure
9 Cinder block	Filler	.....	.....	P	T	G	Waterproofs surface
10 Sand-lime brick	Aggregate	Sand	0.75	P	T	P	Equipment unsuited to fine material
11 Aerocrete	Aggregate	Sand	0.75	L	P	P	Poor concrete; small market
12 Lightweight concrete tile	Aggregate	Sand	0.75	P	T	P	Machine not commercially available
13 Acoustic plaster	Aggregate	Pumice	20.00	..	P	P	Color objectionable; application more important than material
14 Haydite concrete	Aggregate	Haydite	8.00	L & P	T	G	Expensive product; small market
15 Cottrell block	Aggregate & binder	Pulverized shale	.....	L & P	T	E	Active project
16 Sodium-silicate block	Aggregate	.....	.....	L	T	P	Expensive and unsatisfactory
17 Pebble concrete	Admixture	Portland cement	7.50	L	T	G	Reduced heat of hydration
18 Portland cement	Raw material	Clay	00.25–0.50	L & P	T	G	Raised coal consumption
19 Brick	Dusting	Sand	0.75	P	T	P	Stuck in molds
20 Petroleum	Color filter	Fuller's earth	8.00–12.00	L	P	P	Small market
21 Foundry	Dusting and sand	Sand	0.75	P	T	P	Small market
22 Metal	Polisher	Pumice	20.00	L	P	P	Not abrasive enough
23 Cinder concrete	Sintered aggregate	Cinders	.....	L	T	G	Too expensive
24 Flyash cinder concrete	Aggregate	Sand	0.75	L & F	T	E	Active project
25 Sand blasting	Condenser tubes and turbine blades	Sand	0.75	P	..	E	Gives high polish and low metal loss

[a] F = field, L = laboratory, P = plant. [b] P = preliminary, T = thorough. [c] E = excellent, G = good, P = poor.

TESTS 17 BRANDS OF OIL... PICKS

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● SEVENTEEN BRANDS of steam cylinder oil were tested in the power plant of a Central State prison, on two 300 KW steam engines, in an effort to eliminate valve groaning under increased steam pressure and temperature. The only one of the 17 which gave really adequate lubrication was StanoCyl S H.

StanoCyl has been in use, now, two years at this plant. There is every indication that the engines and valves are being lubricated even better than they were before the change to superheated steam was made.

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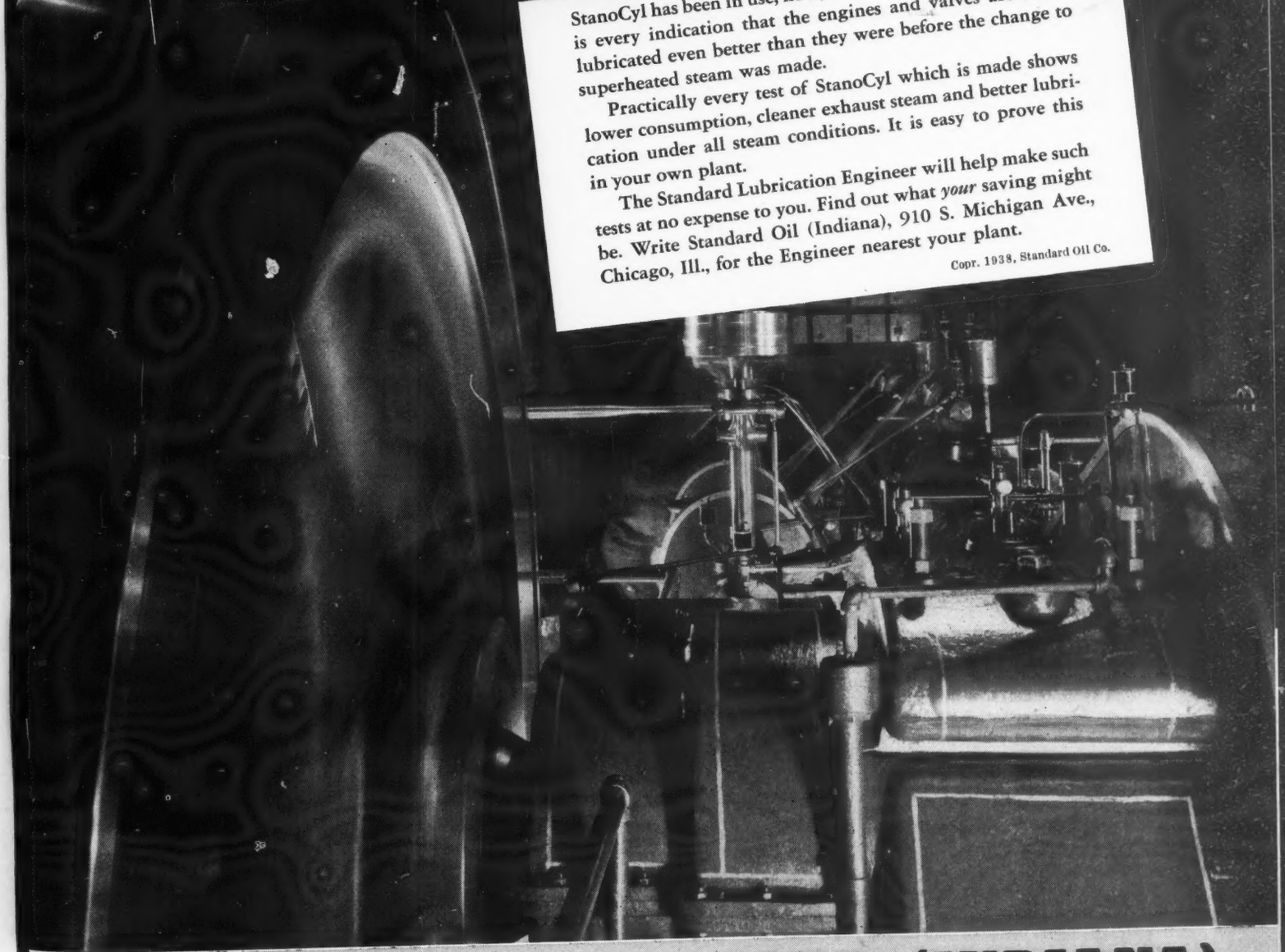

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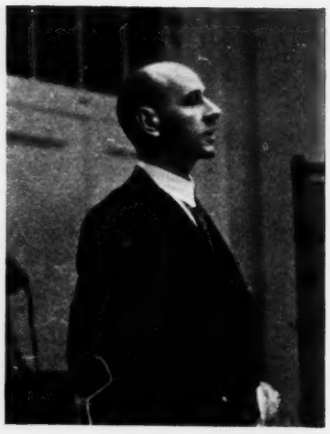
LUBRICATION ENGINEERING — *THE RIGHT LUBRICANT • PROPERLY APPLIED TO REDUCE COSTS*

Professor Keenan, of steam-table fame, explained measurement of friction factors for flow of steam in pipes



Physicist Osborne, National Bureau of Standards, reported redetermination of specific and latent heat of water

The new steam tables have inspired further refinements in basic data for turbine design. Friction of steam in pipes, specific heat of water, models for finding pipe stresses are other subjects of fundamental papers that bring ultimate improvements to power men everywhere

Mathematicians' Corner

WITH NO HOLDS barred as to integral signs, entropy-enthalpy relations and discussions of accuracy to one part in ten-thousand, the thermodynamics session rolled into full speed with two companion papers on reheat factors for steam turbines.

Carefully explained for the initiated in mathematical terms by Professor C G Thatcher, reheat factor is the ratio of the amount of work a pound of steam can do in expanding through the actual stages of a turbine to what it would do in a theoretically complete single stage of the same efficiency. Reheat factors run up to 1.10 and even more under extreme conditions. This means that a turbine designer can expect up to 10% more output from a turbine per lb of steam than a simple calculation would show. This because friction loss in the first and succeeding stages of an actual turbine is being converted into sensible heat in the steam and carried on to the next stage. This slight amount of heat returned to the steam actually results in the steam being able to do more work for a given pressure drop in the next stage. Of course, the amount of work the steam can do is fixed; only the method of calculation was under discussion.

Professor Thatcher, of Swarthmore College, representing the academic branches of the Society, preferred a concrete and practical approach to the determination of reheat factors based on the recent steam table data and presented the results of many computations of such factors for a wide range of pressure conditions in the form of curves and charts.

In a companion paper on the same subject, R B Smith of the Elliott Company, representing the practical viewpoint of the turbine manufacturer, approached the problem from an analytical standpoint. With the aid of calculus, formulas were presented which gave answers coinciding with the reheat factors of Professor Thatcher within small fractions of one percent.

E L Robinson of the General Electric Co suggested that the correction for moisture in low-pressure turbine stages be ignored as a practical matter since it gave considerable trouble in the mathematical development of reheat factors and actually was only one of the variables that entered the calculations of performance of low-pressure blades. Turbine designers, he said, would rather work with a single set of curves if possible and these preferably based on constant blading efficiency.

Friction Factors

Carrying on the theoretical research trend of the meeting, Professor J H Keenan of M I T and steam-table fame, presented "Friction Coefficients for the Compressible Flow of Steam". Tests, according to the curves of the paper, show friction factors for the compressible flow of steam in remarkably close agreement with those for coefficients measured for incompressible flow of fluids such as water. Experiments were made on a 53-ft length of ordinary 1-in. pipe under many conditions of inlet pressure and flow.

In commenting on the paper, J I Yellott, Jr, of Stevens Institute, reported that similar experiments conducted with turbulent entrance conditions agreed well with Professor Keenan's findings, although the tests were as yet only in a preliminary stage.

At the suggestion of the International Committee on Steam Table Research, the Bureau of Standards at Washington undertook two years ago to make new measurements of the specific and latent heats of water. Results were discussed in a paper by N S Osborne, H F Stimson and D C Ginnings of the National Bureau of Standards. Refinements in calorimetry permitted a high degree of accuracy, according to Mr Osborne, and resulted in slightly revised values of the specific heat of water that are expected to bring British experimental results in closer agreement with data developed in this country.

Turning from the abstract mathematics of thermodynamics to the equally complex but more concrete computation of stresses in high-pressure, high-temperature piping, H W Semar of Westinghouse described apparatus for measuring the end reactions and moments of piping systems by means of models. The piping to be studied, said Mr Semar, is bent accurately to scale, of small tubing of the same steel as the pipe to be studied.

Expansion of the piping system due to temperature changes are duplicated, according to the paper, by fixing one end of the pipe and applying load to the free end sufficient to pro-

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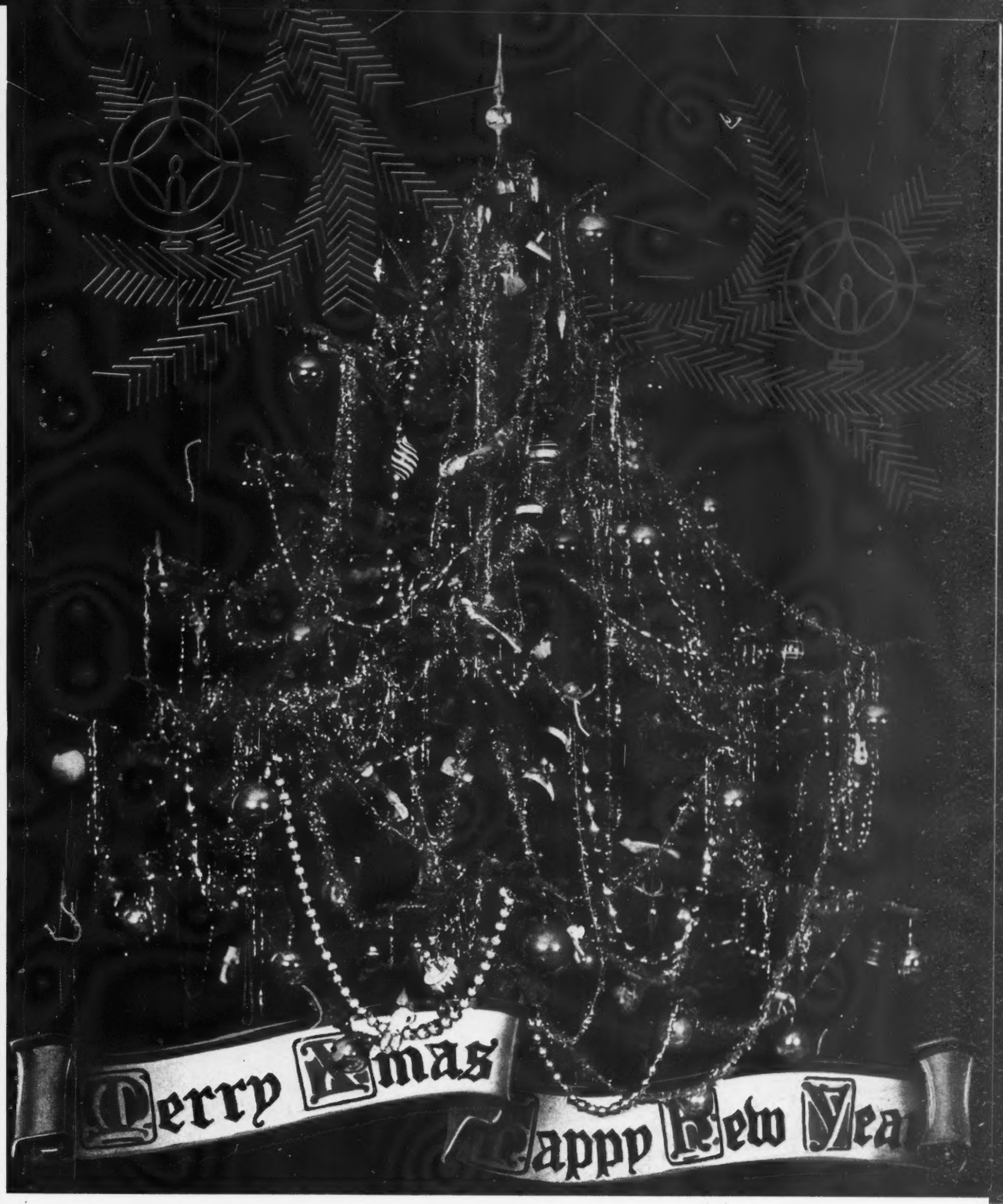

Of course, we are just as glad to get orders for Pre-Fabricated Piping in December as in any other month during the year,—in fact, they help make our Christmas happier. But, instead of using this space to remind you of our ability, facilities and experience, we take this means to wish all of our friends, "Merry Christmas! Happy New Year!" Benjamin F. Shaw Co., Wilmington, Delaware.

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duce the same deflection as would occur due to temperature but in the opposite direction. The fixed end of the pipe is held in a frame that enables the forces to be measured.

The model technique is a substitute for lengthy calculations and can be applied to branch systems by using an additional slide for each branch.

Reporting that the Consumers Power Co has also been using models for calculation of their piping systems, F Hill stressed the fact that solutions to branch problems are now within easy reach of any engineer. Of course, he said, the mathematical ground work already available cannot be neglected as it is needed for interpreting the differences between hot piping and cold model results, and for analysis of differences in stiffness due to valves and pipe hangers. One difference, he added, between the Westinghouse models and his own, is the use of solid rods bent at red heat and stress relieved.

For thick-wall tubing as would be used in high-pressure piping, no advantage is obtained by use of tubing while the uniformity of steel rod improves the reliability of results, according to Professor Karelitz of Columbia University. For piping of large diameter and relatively thin walls, however, tubing more nearly represents the pipe structure. Professor Waters of Yale University commented briefly that the errors introduced by the model technique were small and the application of models was satisfactory if carefully done. Professor Hovgaard, author of many papers on stress calculation, added that the gain from use of models represents an important advance, but that the calculations are not as bad as they appear to the uninitiated and that they become more or less routine after repeated use. However, he noted, models can take any shape while the calculations are somewhat limited in their application.

Under the sponsorship of the Joint Committee on High Temperature, several laboratories are working on problems related to creep at elevated temperatures. Professor F H Norton of Massachusetts Institute of Technology reported on studies of biaxial stress in tubular members. The measurements were made on a 4-in. OD tube with ⅜-in. wall by using an ingenious oil-pump accumulator arrangement to produce nitrogen pressures of 10,000 lb per sq in. Results indicate no longitudinal change even with a high rate of diametral creep. This confirms the theoretical analysis of creep under biaxial stress and indicates slightly lower creep than would be shown by standard tensile specimens.

Reporting on creep rates under conditions of gradually relaxed stress, such as occurs in high-temperature flange bolting, E L Robinson of the General Electric Co, showed results obtained in several laboratories all working independently with somewhat different methods. The results are in generally good agreement, he said, different materials exhibiting markedly different characteristics. The results also apply to such operations as stress relieving, where the operation is one of reducing stresses by raising temperature of the material above what will be encountered in normal use. With materials especially suitable to resist creep, stress relieving will have to be given more time to be effective.

Between Sessions

Election of new officers, presentation of awards, speeches and ceremonies fill out the ASME annual meeting

Francis Hodgkinson was awarded the Holly Medal for his pioneer work in developing the steam turbine

DURING the week of December 5-10, New York was more than a 3-ring circus for visiting engineers. At Engineering Society Headquarters, 29 W 39th St, were the many ASME sessions. At Grand Central Palace was the 13th Exposition of Power and Mechanical Engineerng, and at the Commodore Hotel, ASRE experts discussed air conditioning and allied subjects.

Newly elected ASME officers took over the job of running the Society for the next 12 months. Retiring president Harvey N Davis turned over his gavel to Prof A G Christie of Johns Hopkins, who has been active in ASME affairs for years and is the author of numerous power-field papers. His background includes extended experience in design, erection and operation of power plants. At present, Professor Christie is consulting engineer for Consolidated Gas of Baltimore, Md.

Vice-presidents elected are: William L Dudley, vice-president and chief engineer, Western Blower Co, Seattle, Wash.; James W Parker, vice-president and chief engineer, The Detroit Edison Co; Alfred Iddles, Babcock & Wilcox Co; Henry H Snelling, patent expert.

ASME managers elected are: Clarke F Freeman, Manufacturers Mutual Fire Co; William W Winterrowd, Franklin Railway Supply Co, Chicago; and Willis R Woolrich, Dean of Engineering, University of Texas.

Awards

On "Honors Night", Francis Hodgkinson, turbine pioneer, was signally recognized by award of the Holly Medal for "meritorious service in the development of the steam turbine". For an outstanding paper on locomotive design, the Worcester Reed Warner Medal was presented to Lawford H Fry, Edgewater Steel Co, Pittsburgh. Alphonse I Lipetz, chief consulting engineer in charge of research, American Locomotive Co, received the Melville Medal.

Other recipients of honors and awards included: Wilfred E Johnson, General Electric Co (Pi Tau Sigma Award); Arthur C Stern, New York (ASME Junior Award); Edward W Connolly, Detroit, (Charles T Main Award); Marshall C Long, Princeton, N. J. (ASME Post-graduate Student Award); D C McSorley, Michigan State College (ASME Undergraduate Student Award).

The Henry R Towne lecture, a regular feature of the annual meeting, was delivered this year by Gerard

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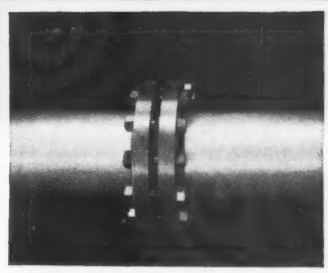

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—*Wide World Photo*

From left to right—Dr Harvey N Davis, Stevens Institute, retiring president; Dean W R Woolrich of the University of Texas, chairman of Local Sections Committee; and president-elect A G Christie of Johns Hopkins

Swope, president of General Electric Co. Praising engineers for their tremendous contribution to human welfare through technical advances, Mr Swope regretted the lag in applying equal skill to related human problems. He said that much of the industrial strife of recent times could have been avoided had engineers paid proper attention to human problems.

In the early days of the machine age, Mr Swope pointed out, long hours, bad working conditions, and low earnings, in many manufacturing industries, led the working man to look upon the machine as his enemy. The wage earner also resented the early introduction of scientific management, fearing that better planning, better management and better machinery might create more "technological unemployment".

Nevertheless, said Mr Swope, the technical contributions of the engineer have made possible the modern high standard of living in which the worker shares. Costs have been lowered so that thousands more can buy a product. In spite of greater production efficiency, many more thousands of people are employed in manufacturing today than were years ago. It takes less labor to produce each article, but the number of articles produced has been greatly increased. This all fits into the economic goal of "more goods for more people at less cost".

The engineer, Mr Swope concluded, is in a particularly good position to interpret the machine age to the wage earner. But first he must be clear himself. He must study industrial history. If management engineers and wage earners can find and interpret the facts of industry and then come to peaceful conclusions, there will be less occasion for laws compelling compliance.

Following long established custom, Wednesday night was given over to banqueting, speech making and ceremonies in the Grand ballroom of the Hotel Astor. Speaking on "An Engineer's Philosophy", retiring president Harvey N Davis stressed the intangible elements of education—the "unconscious tuition" which grows out of the character and spirit of the teacher. The same subconscious transfer takes place in industry, he said; the character of the industrial leader is reflected in the men who work for him.

Howard W Haggard, director of the Laboratory of Applied Physiology, Yale University, delivering the Thurston Lecture, warned engineers not to jump to conclusions in matters of human health and wellbeing. The engineer, he pointed out, finds many "mechanical" devices in the human body, such as the pump (heart), bellows (lungs), etc. From this, he imagines that physiology is nothing but a branch of engineering, which is far from true.

Unlike a machine, the body is alive. It acts as a whole; no part can be considered separately. Professor Haggard urged engineers not to ride roughshod over the laws of physiology but to study and work with them. For example, engineers strive to maintain extremely constant temperature and humidity conditions. Such over regulation by machines may cause the internal body control centers to become inefficient through disuse.

Following a custom established some years ago, a group of industrial power men met at the Midston House on Thursday for luncheon and discussion of their plant problems. This meeting, open to all interested, was handled as an activity outside the regular ASME program. A similar meeting will be held next year. Chairman is F M Gibson, American Sugar Refining Co, Brooklyn, N. Y.

News of Air Conditioning, Refrigeration

THE 34TH Annual Meeting of the American Society of Refrigerating Engineers, held December 6-8, Hotel Commodore, New York, N.Y. centered its attention on air conditioning and commercial foods refrigeration. In the first classification and in a session on refrigeration in industry were several papers of interest to power engineers, one of which was "Trends in Compressor Design", by H C Guild, Vilter Mfg Co.

These topics share limelight at ASRE Annual Meeting

Mr Guild, in summarizing improvements of the past few years, pointed out: (1) That greater capacities have been obtained by use of lighter and better designed reciprocating parts, and more efficient bearings. The author remarked that the limit of speed has by no means been attained. (2) There has been a decided improvement in crankshaft construction. Shafts have been shortened, main bearings given a wider margin of safety, and need of long overhanging bearings eliminated by use of roller bearings as outer guides and additional support to main bearings.

(3) Removable bushings are being used in all compressor parts, even to the extent of replaceable alloy cylinder

POWELL STEEL VALVES

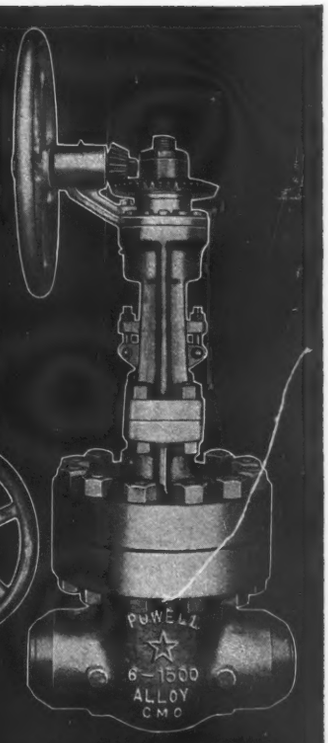

FIG. 1303 — CAST ALLOY STEEL GATE VALVE, GEAR OPERATED.

FIG. 3003—CAST STEEL GATE VALVE, GEAR OPERATED.

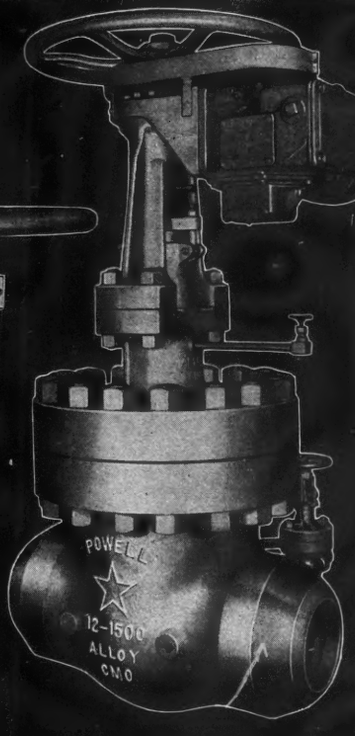

FIG. 1323 — CAST ALLOY STEEL GATE VALVE, WITH BY-PASS — MOTOR OPERATED.

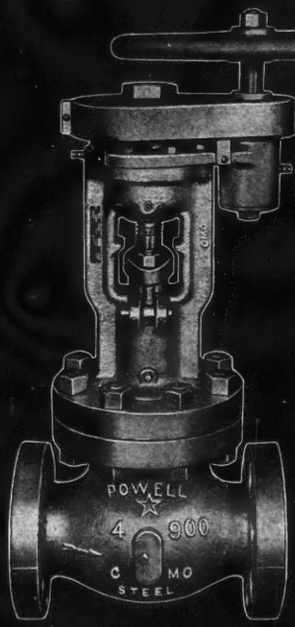

FIG. 9031—CAST ALLOY STEEL GLOBE VALVE, GEAR OPERATED

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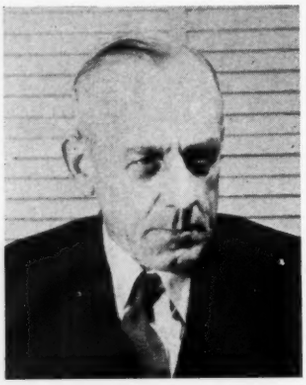
liners. (4) Gas speeds have been reduced down to around 4500 fpm, because of increased valve area. Considerable speed increase can be obtained before valves will again have to be improved, said Mr Guild. (5) Lubrication efficiency has been stepped up, as for example, in improved conventional compressors using double force-feed lubricating systems. Because of this and better general construction,



H C Guild summarized trends in compressor design

horsepower requirements have been reduced somewhat, but Mr Guild pointed out that there is still room for improvement at this point.

R H Heilman, Mellon Institute of Industrial Research, and R A MacArthur, The Philip Carey Mfg Co, in "Metal and Asbestos Ducts in Air-Conditioning Systems", reported results of comparative tests on metal duct and the recently developed all-asbestos insulating air-conditioning duct. (See page 43 of this issue for description of the asbestos duct.) Data was given on friction loss, sound-deadening characteristics, and heat transmission.

Their findings, in general, favored the all-asbestos duct. For example, heat-transmission tests showed that for a 5½x5½-in. duct, Btu loss per ft at an air velocity of 500 fpm was 16.6 for ½-in. asbestos duct and 21.7 for tarnished metal duct.

As a result of the high cost of dehumidification by refrigeration, considerable attention has been focussed on chemical dehumidification as a means of controlling relative humidity at relatively low cost, according to Stewart C Coey, Research Corp. Pointing out that the moisture content of air delivered by a brine dehumidifier depends on temperature of brine and leaving air, and concentration of brine, the speaker went on to describe three general classes of chemical dehumidifiers. In the first, there is no change in total heat or wet bulb, so extremely low relative humidity must be produced to get low dewpoints. In the second, the brine absorbs the latent heat of moisture removed from the air, and is cooled by external means. In the third, the brine is sprayed over extended-surface cooling coils so that air and brine are both cooled in passage.

Brine may be reconcentrated by boiling the water off as steam, or by evaporation in air at temperatures below the boiling point, said Mr Coey. Boiling is limited to brines designed for outlet humidities of from 40 to 60%. The air concentrator is basically the same as any mechanical draft cooling tower, except that brine must be heated if it is to give up moisture to outside air.

Controls for chemical dehumidification are relatively simple and cost of heat to reconcentrate the brine is low, making this type of equipment attractive from an operating standpoint. The author pointed out that with cost of dehumidifying fresh air reduced greatly, more fresh air could be used in restaurants and theatres where ventilation is a problem.

Air conditioning reduces the incidence of post-operative pneumonia and surgical deaths, lowers infant mortality, overcomes immediate attacks of hay fever and asthma in extreme cases and is of diagnostic and therapeutic value, summed up Dr Albert G Young of Corey Hill Hospital, Brookline, Mass., in a paper on "Status of Hospital Air Conditioning". Most of the paper was devoted to a discussion of the air conditions most desirable for certain types of patient. In addition, Dr Young drew certain practical conclusions useful to those faced with designing or operating air conditioning

R H Heilman reported on asbestos duct

equipment for a hospital. Thus, it was pointed out that the biggest gain from air conditioning was in recovery rooms and that the first funds obtained for air conditioning would be best spent there. Practical points on keeping rooms for hay fever patients free of pollen were given and emphasis was laid on the conclusion that no general recirculation of air should be permitted in a hospital.

Other papers of possible interest to power men were "Air Conditioning at Low Temperatures in Aircraft Engine Laboratories," by John R Monsell; "Laboratory Aspects of Low Temperature Refrigeration," by A V Ritchie, N H Hiller, and A F Brewer; "Air Pollution and Its Relation to Weather," by David R Morris; and "Refrigeration Requirements of the Wine Industry," by G L Marsh.

✦ ✦ ✦

Questions for Boiler-Room Engineers

By HARRY M SPRING

Q—When making welding repairs on a steel boiler (where allowed), which is preferable and why: the electric arc or the oxy-acetylene method?

A—Electric arc is used as it quickly brings the small area to be welded to high temperature without heating and disturbing adjacent parts by expansion.

Q—When making welded repairs on cast iron which is preferred: the electric arc or oxy-acetylene method?

A—Oxy-acetylene is preferred as sudden intense heat may cause cracking. Oxy-acetylene method allows necessary preheating.

Q—If a tube hole in the front tube sheet of a fire-tube boiler is scored by removing a badly scalded tube, and the new tube cannot be rolled in tight against leakage, what would you do?

A—The tube hole should be smoothed by reaming lightly, or with a half-round file and emery cloth. A ferrule of copper or similar soft metal should be used.

Q—Would you caulk and test a riveted seam, that had been leaking, with all pressure released, or under steam, air or cold water pressure? Why?

A—It is dangerous to caulk a seam under pressure of any expansive substance such as steam or air, for the seam might rupture and cause an explosion. It is best to caulk without pressure or under low-pressure of water at room temperature. The seam should be tested by raising water pressure to one and one-half times maximum allowable working pressure.

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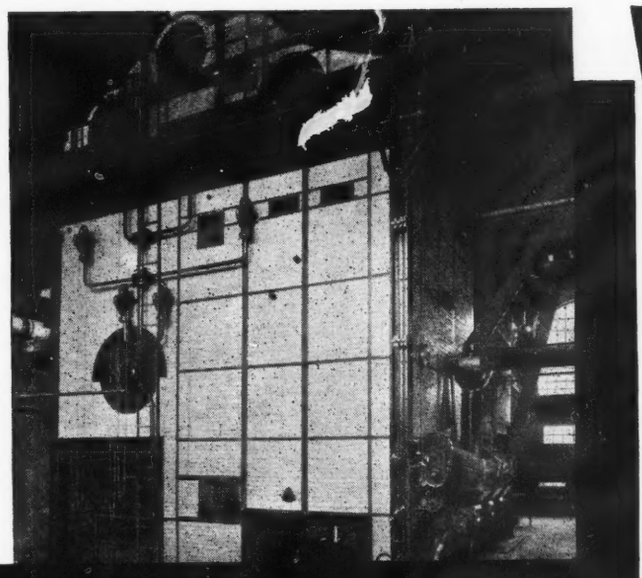
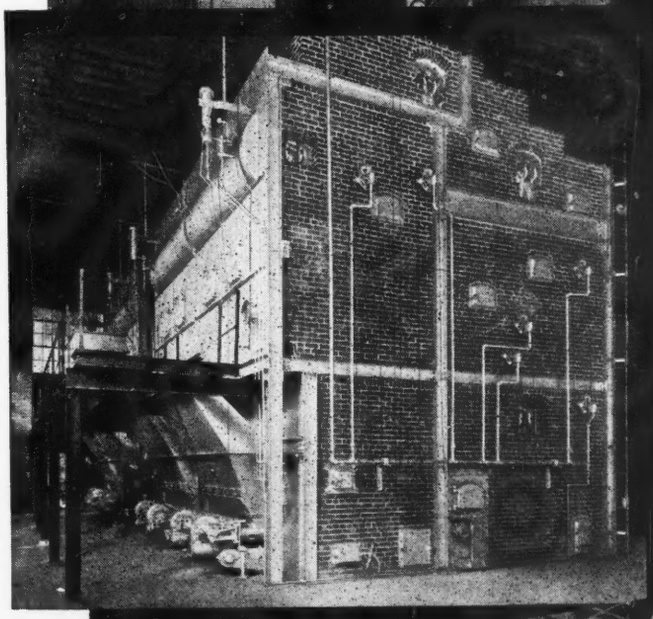
Installations

by

Vogt





-: Recently completed or on order :-

Terrell State Hospital	Terrell, Texas
Municipal Water & Light Plant	St. Mary's, Ohio
U. S. Veteran's Hospital	Leavenworth, Kan.
Elyria Memorial Hospital	Elyria, Ohio
City of Chicago	Chicago, Ill.
Village of Napoleon	Napoleon, Ohio
Madison State Hospital	Madison, Ind.
Hope Water & Light Co	**Hope, Ark.**
Georgia State Prison	Reidsville, Ga.
Municipal Light & Water Utility	Richland Center, Wis.
City Hospital	Columbus, Ohio
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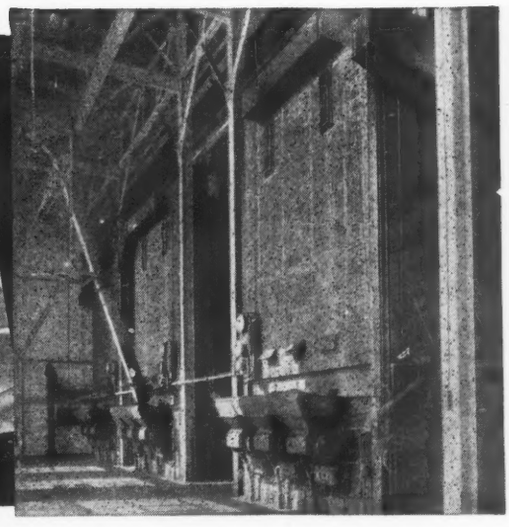

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Is There a Santa Claus?

Some years ago, "The Sun" printed the following editorial, written by Frank P. Church in answer to the question of a little New York girl. I've reread it Christmas after Christmas, and I thought maybe you'd want to, too—G E

Dear Editor—

I am 8 years old.

Some of my little friends say there is no Santa Claus.

Papa says "if you see it in 'The Sun' it's so!"

Please tell me the truth, is there a Santa Claus?

VIRGINIA O'HANLON

Virginia, your little friends are wrong. They have been affected by the scepticism of a sceptical age. They do not believe except they see. They think that nothing can be which is not comprehensible by their little minds. All minds, Virginia, whether they be men's or children's, are little. In this great universe of ours man is a mere insect, an ant, in his intellect, as compared with the boundless world about him, as measured by the intelligence capable of grasping the whole of truth and knowledge.

Yes, Virginia, there is a Santa Claus. He exists as certainly as love and generosity and devotion exist, and you know that they abound and give to your life its highest beauty and joy. Alas! how dreary would be the world if there were no Santa Claus! It would be as dreary as if there were no Virginias. There would be no childlike faith then, no poetry, no romance, to make tolerable this existence. We should have no enjoyment, except in sense and sight. The eternal light with which childhood fills the world would be extinguished.

Not believe in Santa Claus! You might as well not believe in fairies! You might get your papa to hire men to watch in all the chimneys on Christmas Eve to catch Santa Claus, but even if they did not see Santa Claus coming down, what would that prove? Nobody sees Santa Claus, but that is no sign that there is no Santa Claus. The most real things in the world are those that neither children nor men can see. Did you ever see fairies dancing on the lawn? Of course not, but that's no proof that they are not there. Nobody can conceive or imagine all the wonders there are unseen or unseeable in the world.

You tear apart the baby's rattle and see what makes the noise inside, but there is a veil covering the unseen world which not the strongest man, nor even the united strength of all the strongest men that ever lived, could tear apart. Only faith, fancy, poetry, love, romance, can push aside that curtain and view and picture the supernatural beauty and glory beyond. Is it all real? Ah, Virginia, in all this world there is nothing else real and abiding.

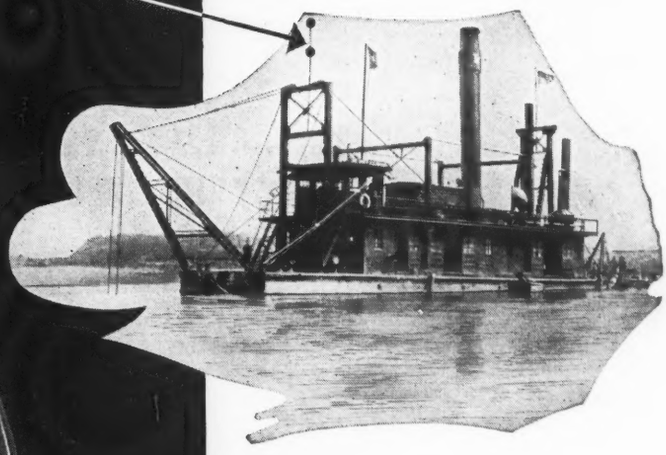
No Santa Claus? Thank God he lives, and he lives forever. A thousand years from now, Virginia, nay, ten thousand years from now, he will continue to make glad the heart of childhood.

May the spirit of Santa Claus make glad your heart during 1939

George Edwards

Engineer

PUMPS AT WORK! DREDGING SCHEDULES MAINTAINED....



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Composition	*Specified Range*	*Actual Composition*
Carbon	0.35/0.45%	0.40%
Manganese	0.60/0.90%	0.85%
Phosphorus and Sulphur	0.40% Max.	0.020%
Nickel	1.75/2.00%	1.86%
Chromium	0.60/0.90%	0.86%
Molybdenum ...	0.15/0.30%	0.25%

Physical Properties	*Specified Minima*	*Test Results*
Yield Point (psi) ...	65,000	72,500
Tensile Strength (psi)	100,000	104,000
Elongation in 2".....	18.0%	21.0%
Reduction of Area ...	30.0%	39.7%

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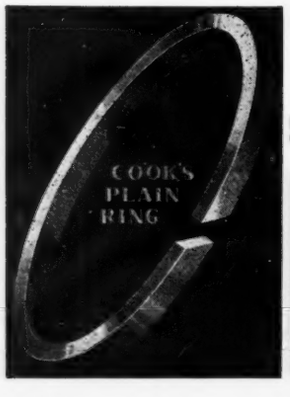

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Defense Power Committee Approves Standardization of Turbine-Generator Units Above 10,000-kw Capacity

On Nov. 14, the National Defense Power Committee approved the report of its Subcommittee on Standardization establishing, for the first time in the history of the electrical industry, preferred standards for steam turbine-generators of 10,000 kw rating and above with a view to expediting the production and reducing the costs of such equipment. The adoption of these standards is expected to materially accelerate the construction and erection of generating stations to provide additional supplies of electric energy. The Committee is considering similar determinations for generators of smaller ratings.

Definite standards of pressure, temperature, voltage, power factor and other technical features, are provided for nine sizes of condensing turbines, ranging from 10,000 to 100,000 kw and for eight sizes of superposed turbines ranging from 10,000 to 60,000 kw. In the past, turbines and generators of these large capacities have been chiefly "tailor-made jobs" built to order on special designs prepared by utility engineers. This has meant the expenditure of a large amount of time on engineering and design for each machine and has in large part prevented the adoption of quantity methods of production.

Provision for Advances

The Subcommittee on Standardization, of which Commissioner Basil Manly of the Federal Power Commission is Chairman, while establishing these preferred standards, has provided sufficient latitude for modification of the standards to meet special conditions arising in connection with the installation of new equipment in existing plants or where unusual physical conditions must be met. Provision is also made for consideration of technical advances in the art. But, in every case where deviation from the preferred standards is suggested, the burden of proof will be upon the utility or manufacturer proposing such deviation. The Committee will at all times welcome constructive suggestions from the industry.

These provisions are emphasized in the technical report prepared for the Subcommittee by Dr John C Parker, president of the American Institute of Electrical Engineers and vice-president of the Consolidated Edison Co, representing the utilities; Mr C E Coggeshall of the General Electric Co, representing the electrical-equipment manufacturers, and Mr Thomas R Tate, representing the National Defense Power Committee. This report states:

"Your Subcommittee on Standardization of Turbine Generators has held two meetings, at which representatives of the turbine-generator manufacturers, utilities and the Government were present and cooperated wholeheartedly in discussing the adoption of preferred standards for steam turbine generators

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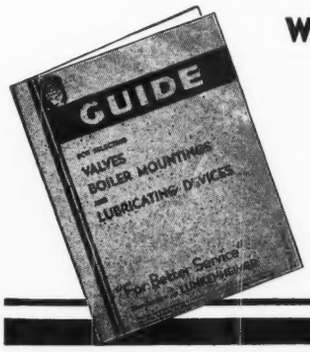

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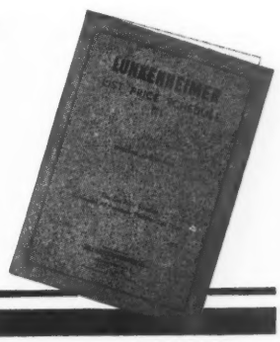

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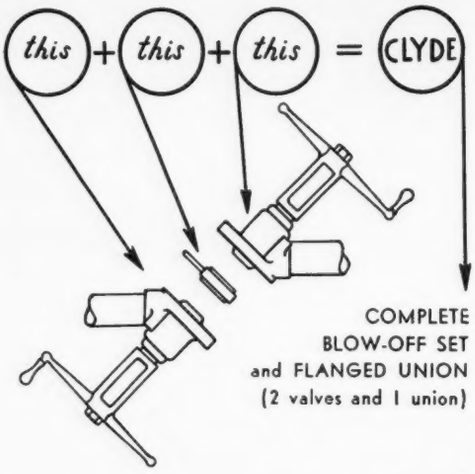

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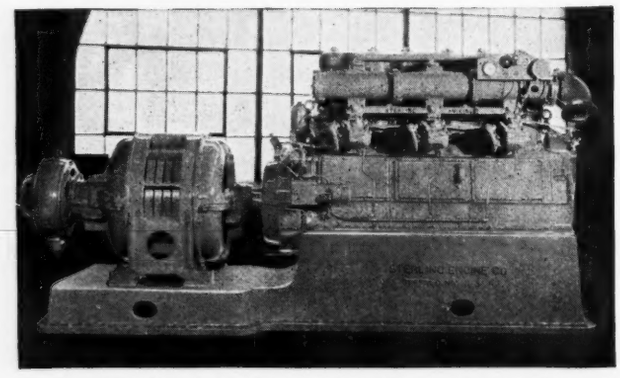

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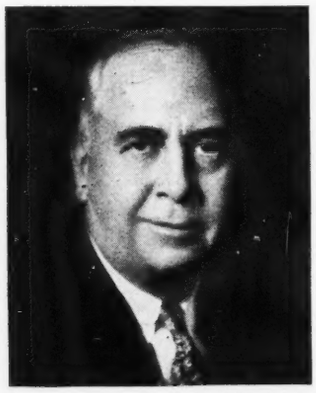
of 10,000 kw rating and above. The Subcommittee has unanimously agreed upon and recommends for adoption by industry and the manufacturers the standards set forth herein.

"The immediate objective of the establishment of preferred standards for turbine-generators is the maximum speed of provision of power facilities to anticipate peace-time requirements and to facilitate war-time provision of power through elimination of any unnecessary special designs or sizes. It is expected, incidentally, that the cost of power-plant installations will be sufficiently reduced to compensate for any added economy or other advantages that might result from more special designs.

"It is the belief of your Subcommittee that the advantages of preferred stand-



—Blank & Stoller Photo

Basil Manly

Commissioner of the Federal Power Commission and Chairman of the Subcommittee on Standardization

ards as here recommended for turbine-generators will be reflected also in such associated equipment as boilers and appurtenances, steam piping, valves and fittings.

"It is the intention that the preferred standards agreed upon by representatives of the Government, the manufacturers and the utilities will be followed in the building of all new generating stations and in all installations within existing stations unless interrelation with existing equipment clearly calls for special designs. Deviation from these proposed standards, if of decided advantage to the public, or if necessitated by physical conditions, or by the fundamental purpose of rapid creation of power facilities for national defense, will be deemed to be consistent with this program. In all such cases the burden of clear proof rests upon any one proposing such deviation.

"Illustrative of such cases in which deviation will be deemed to be in the spirit of this program—but not intended to be all inclusive—are the following:

"(1) The temperature of condensing water supply may require turbines designed for operation with backpressures higher than herein provided.

"(2) The present availability in manufacturers' plants of turbine-generators well advanced in production points clearly to the completion and use of such equipment.

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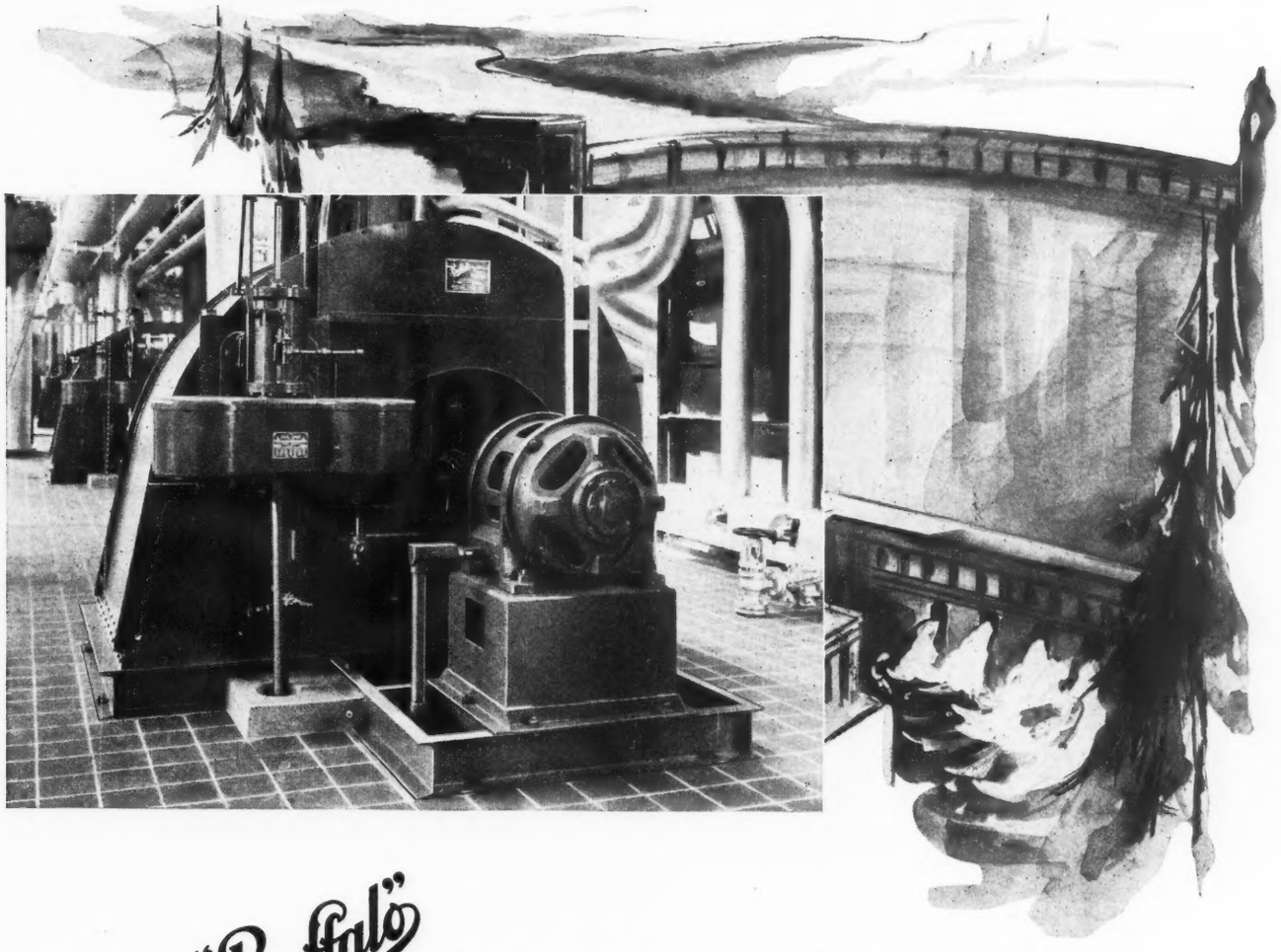

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"(3) Duplication of a turbine-generator, not currently discontinued by the manufacturer as an active design, may expedite manufacture and installation of power facilities.

"(4) The manufacture and installation of turbine-generators adapted to meet essential requirements in existing stations may facilitate rapid creation of generating capacity.

"The preferred standards are intended to be progressive standards and, consistently with the fundamental purpose of expediting production and installation of power generating equipment, are intended to permit technical and economic developments. To that end they should, at least annually, and as occasion seems clearly to warrant, be reviewed to determine whether advances in the art call for specific modification."

Those participating in the conferences which resulted in the recommendations of preferred standards for steam generators were: For the National Defense Power Committee—Assistant Secretary of War Louis Johnson; Federal Power Commissioner Basil Manly; Captain William R Winslow; Mr Thomas R Tate; Lt-Colonel L E Atkins, U.S. Army; Commander K B Bragg, U.S. Navy.

For the electrical equipment manufacturers—Allis Chalmers Company: A C Flory, R N Landreth. General Electric Company: C E Coggeshall, A F E Horn, A R Smith, A O White.

Westinghouse Company: C A Bercaw, C B Campbell, G H Cox, Ralph Kelly, C F Lloyd, R A McCarty. For the electric utilities: K M Irwin, Philadelphia Electric Co.; H B Gear, Commonwealth Edison, Chicago; John C Parker, Consolidated Edison, New York.

Gas Mine

GASIFICATION of coal at the mine, which has engaged the attention of Russian scientists for some years, has reached a practical stage, according to recent reports.

Experiments were conducted in five mines with coal ranging from anthracite to lignite, and with coal crushed by mechanical means and coal in the natural state. In the case of the latter, air charged with varying quantities of oxygen was blown through the coal beds as part of the gasification process. The method of production makes it possible, regardless of existing conditions and coal character, to control chemical composition of the gas. For example, at the Gorlovka experimental mine in the Donetz Basin, where approximately 388,500,000 cu ft of gas has been manufactured, the product could be changed at will from "power gas," suitable for firing boilers in electric generating stations, to "process gas," fit for making benzine and ammonia or for the direct reduction of metals from their ores. This was done by increasing or cutting down the oxygen content of the air.—*Compressed Air Magazine.*

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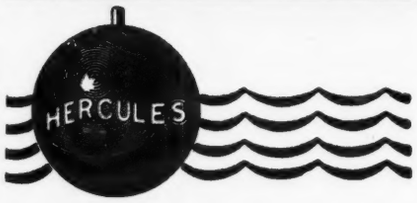

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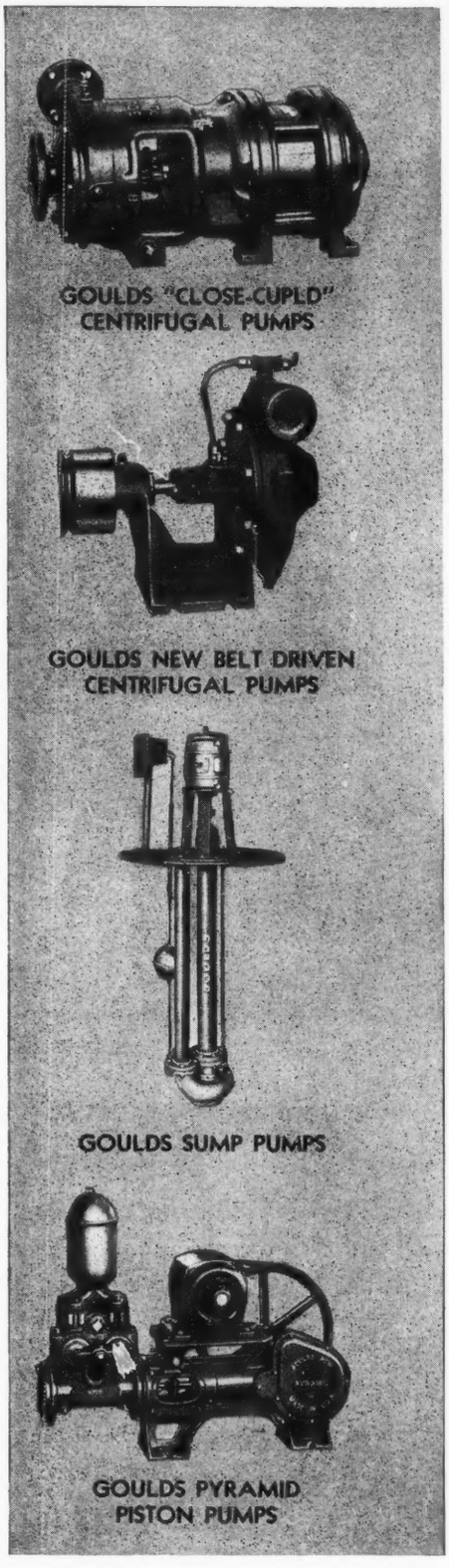
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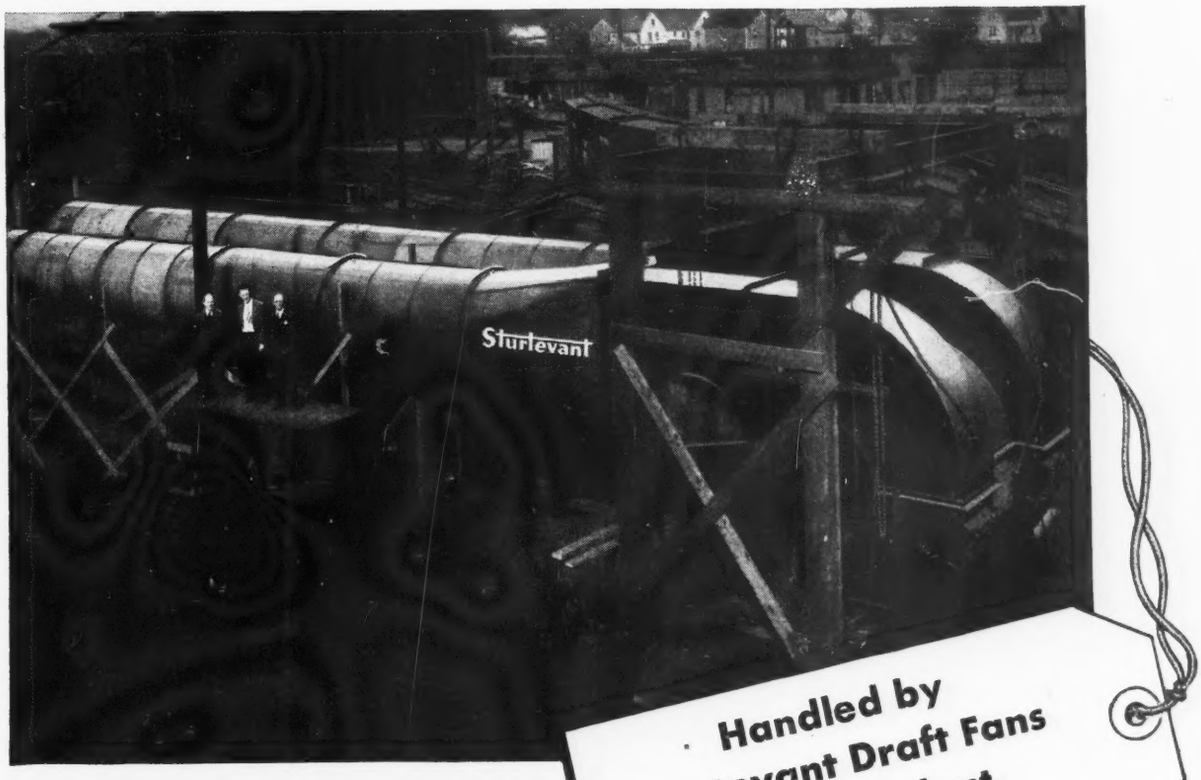

This Sturtevant Induced Draft Fan, now operating in the Logan Plant of Appalachian Electric Power Company, is the world's largest. Photograph was taken during test, before shipment.

Handled by Sturtevant Draft Fans at Logan Plant
Appalachian Electric Power Company

FOUR Sturtevant Forced and Induced Draft Fans in this plant handle a total of 1450 tons of gas and air per hour.

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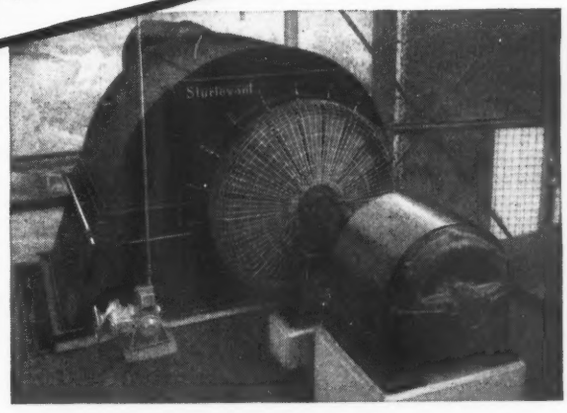

Sturtevant Forced Draft Fan at Logan Plant, Appalachian Electric Power Co. Photograph taken during installation.

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Above: Plant at Lockhart, South Carolina, and two Poweram stokers in 150 h.p. HRT boilers. These stokers have increased boiler efficiency, cut steam costs, made fuel cost savings of $2,500 a year.

Lower left: Monarch Mills at Union, South Carolina, where two Poweram stokers are installed in 200 h.p. water tube boilers.

Lower right: Ottaray plant at Union, South Carolina, where one Poweram stoker is installed in a 150 h.p. water tube boiler.

PERFORMANCE beats claims every time. Here is a performance report on Iron Fireman Poweram stokers with a moral to every man who seeks lower steam costs.

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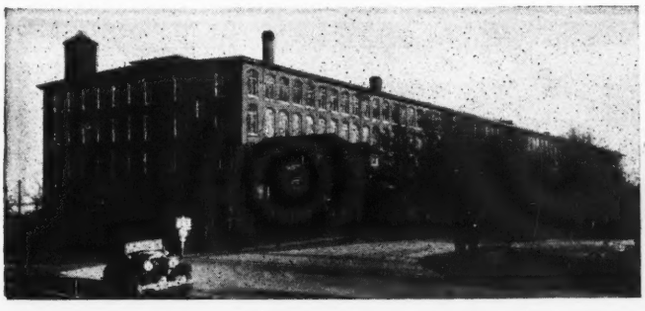

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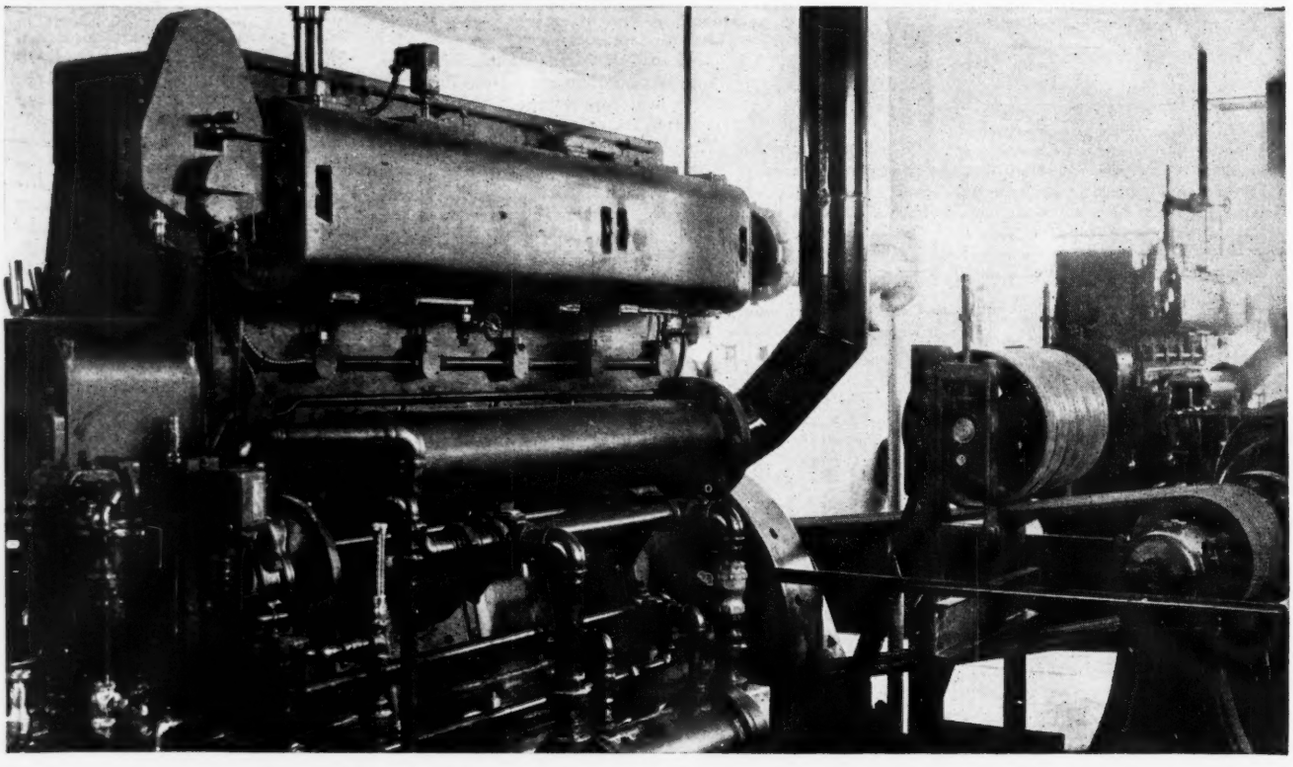
Superior Diesels here, as everywhere, give the dependable, economical service for which they were designed. No other source of power presently available could be found by this farmer-operated project to do the work at a cost so low.

Left—Located only ¼ mile from the Big Horn River, the pumping station, designed by Bell & Donnell, consulting engineers, receives its water by a diversion dam and gravity flow to the forebay from which the pumps elevate it approximately 69 feet at the rate of 35 cubic feet per second.

Below—Two Superior 5-cylinder 9" x 12" Diesels, V-belted to Goulds Fig. 3450-16" pumps, easily met the exacting performance tests specified for this station.



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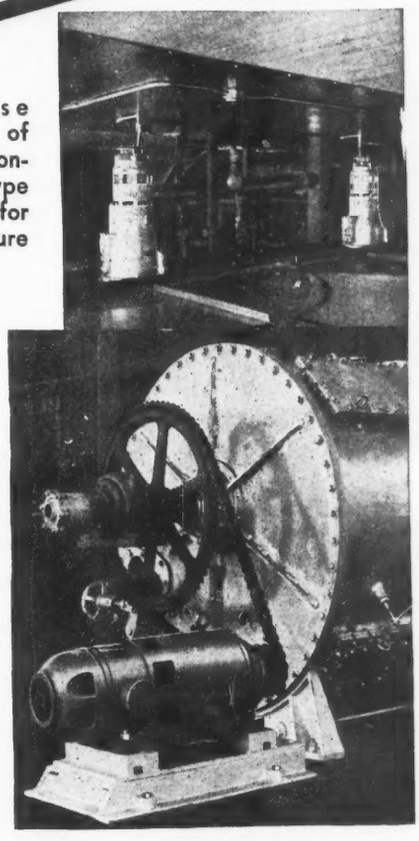

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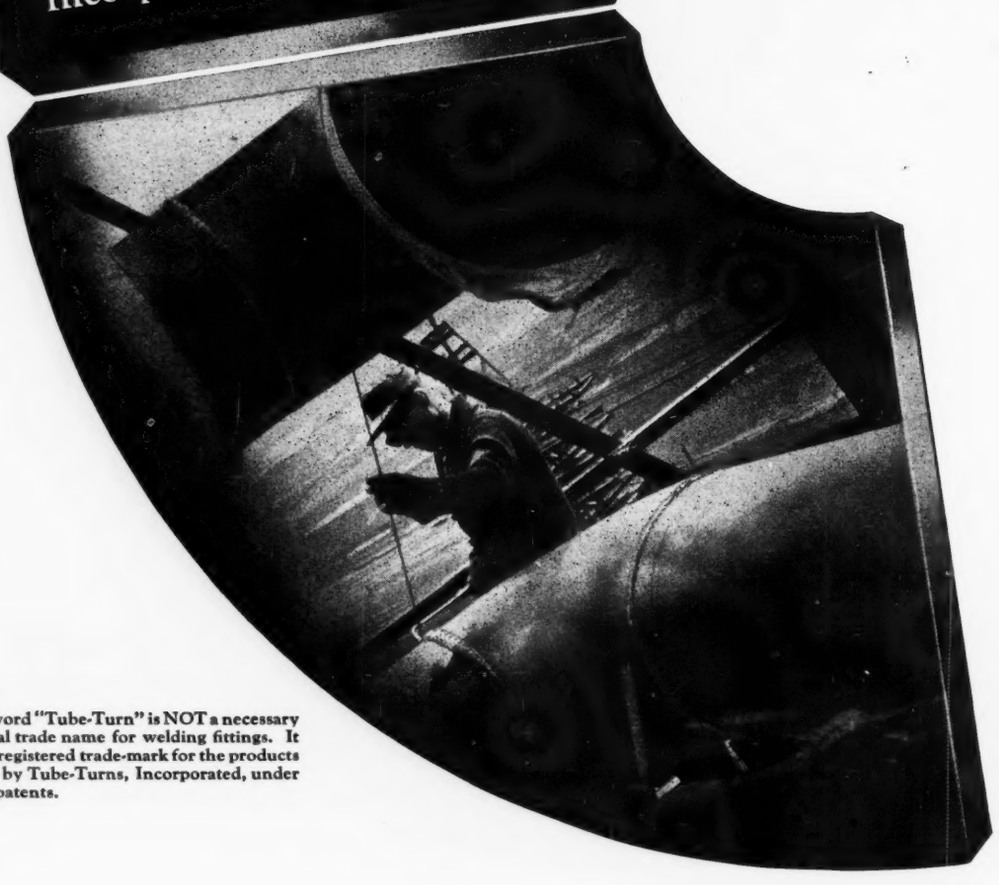

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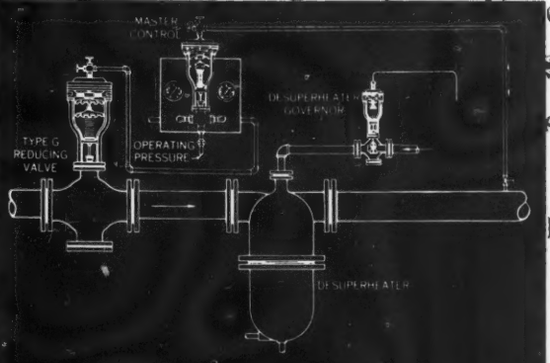

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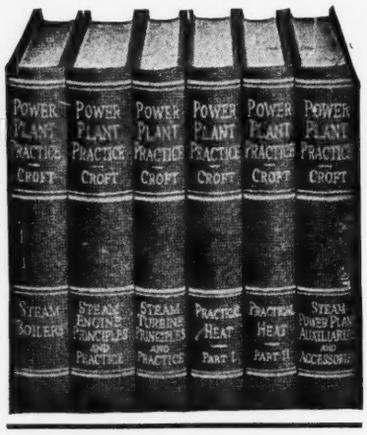
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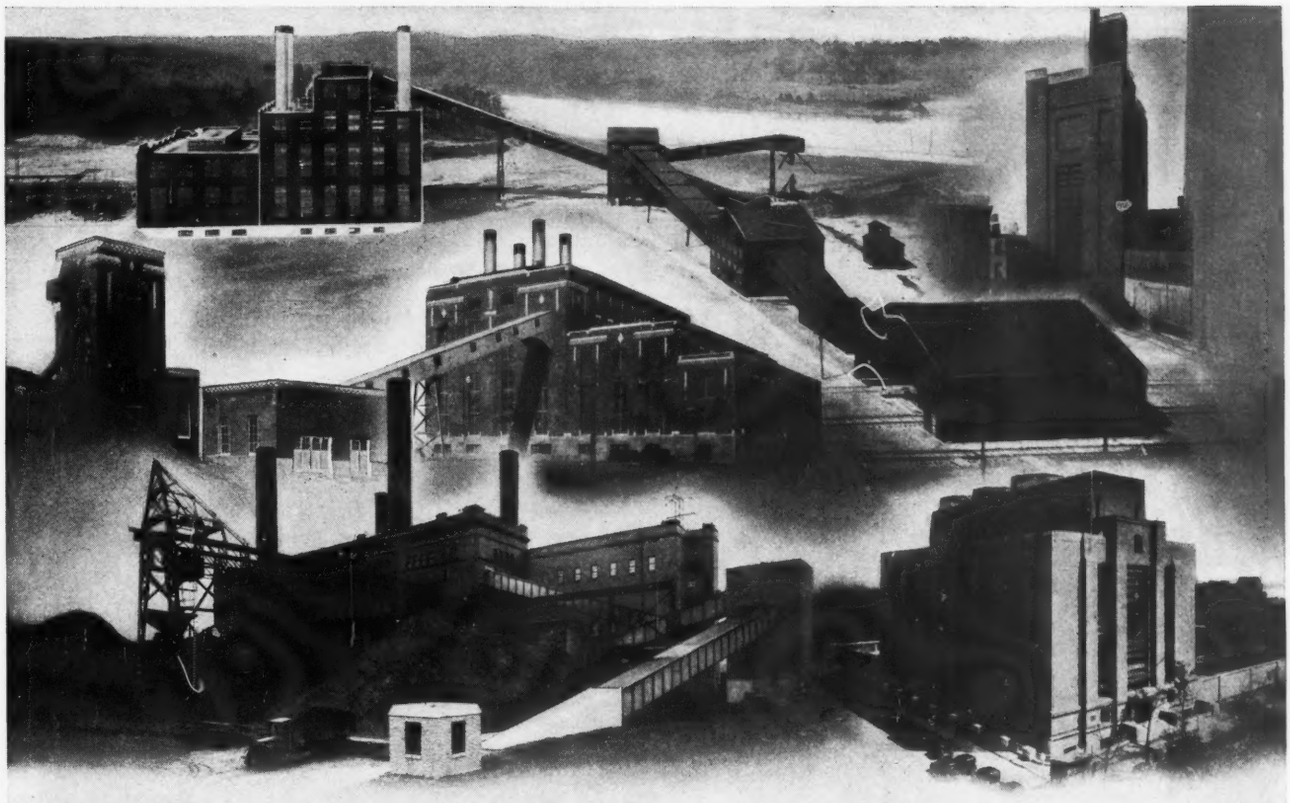

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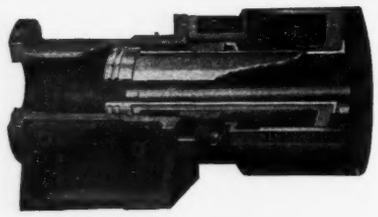

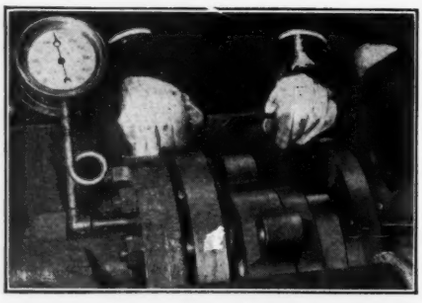

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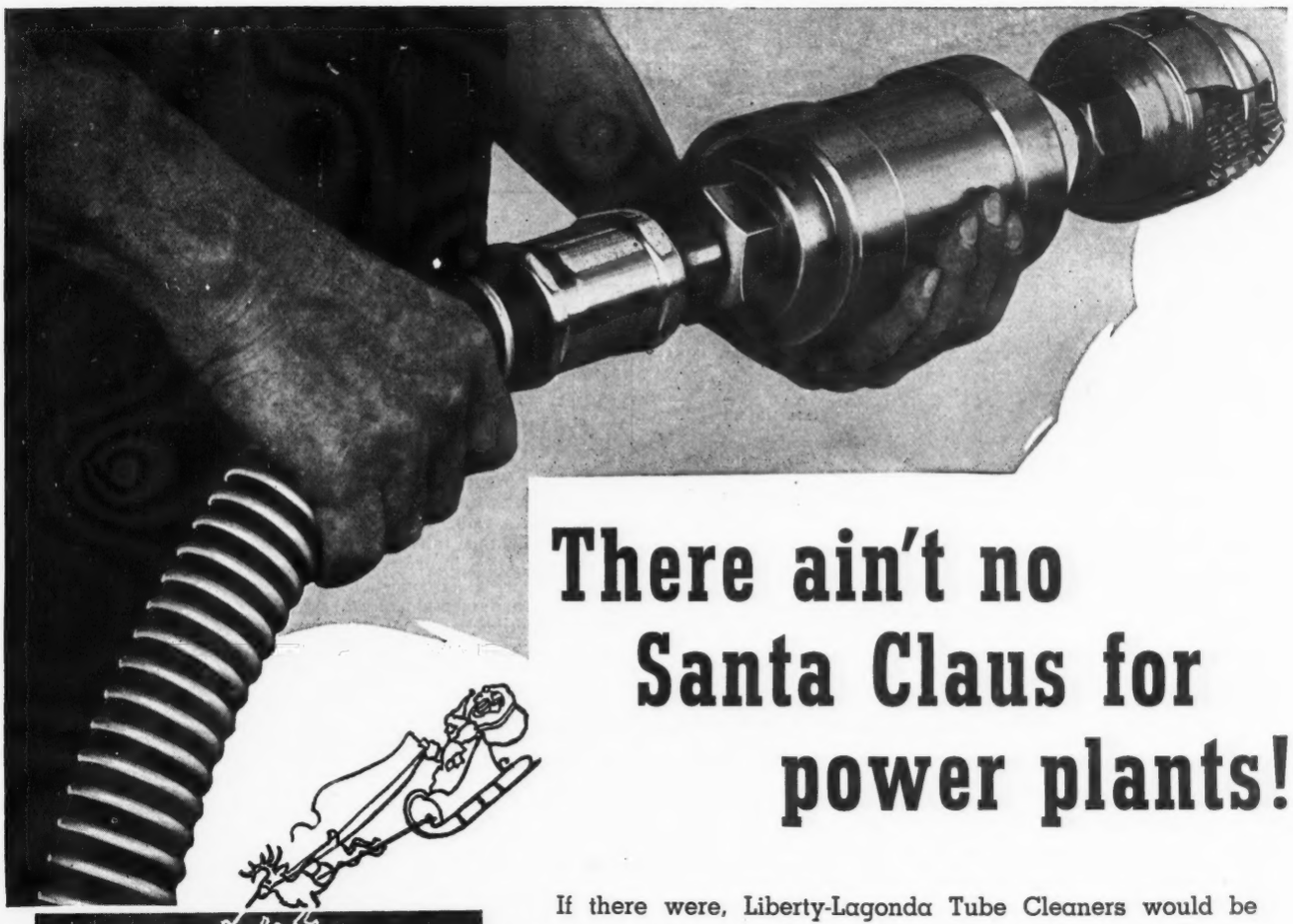

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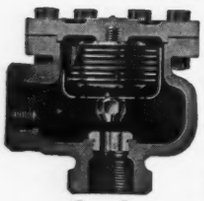

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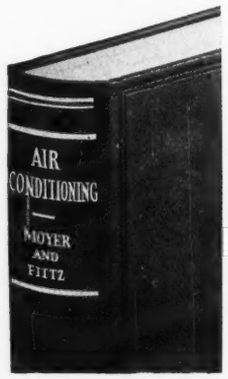

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- ☐ Moyer and Fittz—Air Conditioning, $4.00
- ☐ Anderson—Diesel Engineering—A Textbook, $3.00
- ☐ Sparks—Theory of Mechanical Refrigeration, $3.00
- ☐ Steiner—Oil Burners, $4.50

Name .....

Address .....

City and State .....

Position .....

Company .....P. M-38

(Books sent on approval to U. S. and Canada only.)

WHERE TO BUY

SUPPLEMENT

Featuring additional products and specialties for power plants

ONE INEXPENSIVE MODERN DEVICE . . . .

installed at a crucial spot can frequently remove the "bugs" from an entire process.

It's the faster and surer electrical and mechanical "helps" and "hazard removers" that reduce costs and save company money.

One product advertised on this page may be the answer to *your* problem . . . *a real money-saver for your company.*

To be informed—and reminded—on modern aids to efficient and economical plant operation, check "Service Section" Advertising regularly . . . *every issue.*

For additional information write

Departmental Advertising Staff

POWER

330 West 42d St., New York City

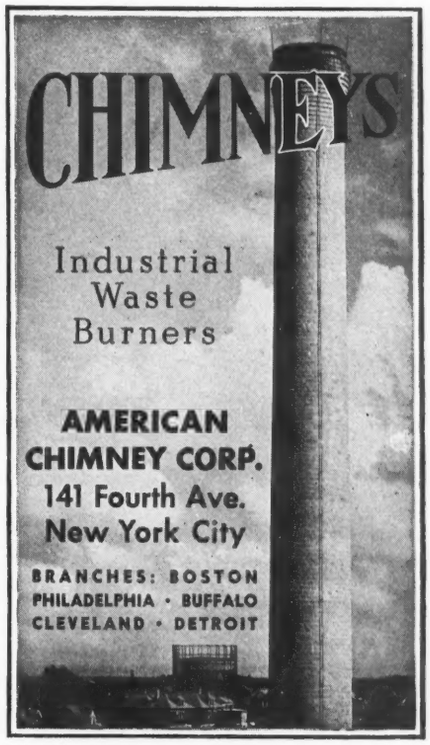
"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
REFRACTORY CEMENTS
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA St., Buffalo, N. Y.

SEAMLESS COPPER FLOATS THAT SAVE MONEY
Naugatuck Seamless Copper floats for receivers, steam traps, separators, etc., are tested to 300 lbs. and are guaranteed for one year. Write for prices.
NAUGATUCK MFG. CO.
460N.MainSt.,Naugatuck,Conn.

O-Z IMPROVED TACHOMETERS
Universal Type 40-50,000 R.P.M.
FIXED READING DEVICE
Read Speeds at leisure: R.P.M., F.P.M. Also Speed Fluctuations. Send for catalog.
O. ZERNICKOW CO.
21 Park Row New York

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

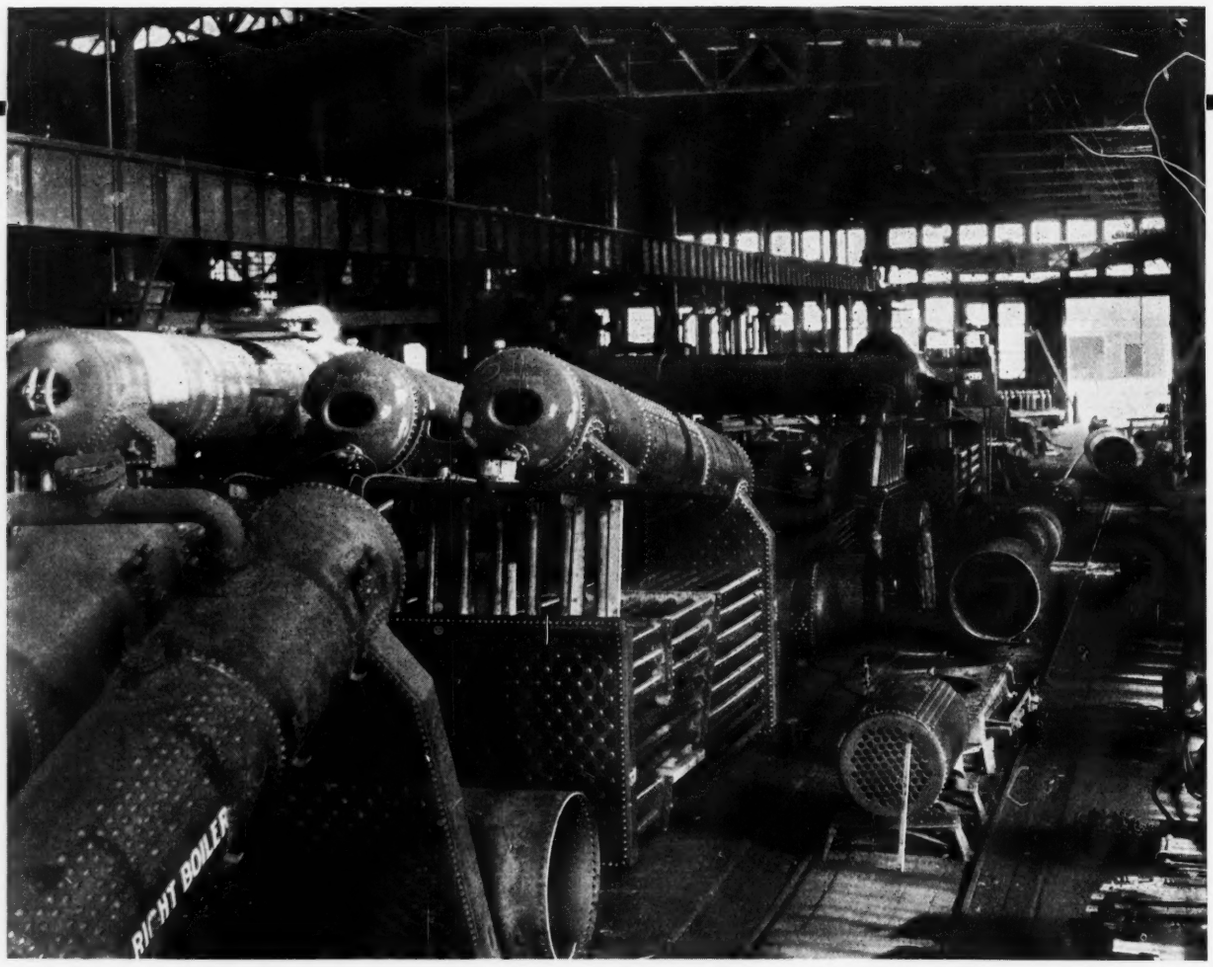
Find what you are looking for? If this or other advertising in this issue does not supply the information wanted, of products or services, write
Power
330 West 42nd Street, New York City



MEASURE SPEEDS with the S&S SPEED INDICATOR
George Scherr Co., Inc.
130 Lafayette Street, New York, N. Y.

THE PURE OIL COMPANY
PURE THREE POINT LUBRICATION
REFINING APPLICATION INDUSTRIAL DEPT. THREE POINT SERVICE CRUDE
A COMPLETE LINE OF INDUSTRIAL PETROLEUM PRODUCTS
OIL CO.
CHICAGO, U.S.A.

Copy for the Service Section of the next issue of Power is required on or before Friday, December 16th.



View of One Bay in
MURRAY BOILER SHOP

The above view shows one bay of our Boiler Shop, showing the large Type "A" Boilers in the foreground in various stages of construction.

The smaller boilers and shells on the right are also shown in different stages of construction.

Our completely equipped shop is geared to produce all types of boilers quickly and efficiently.

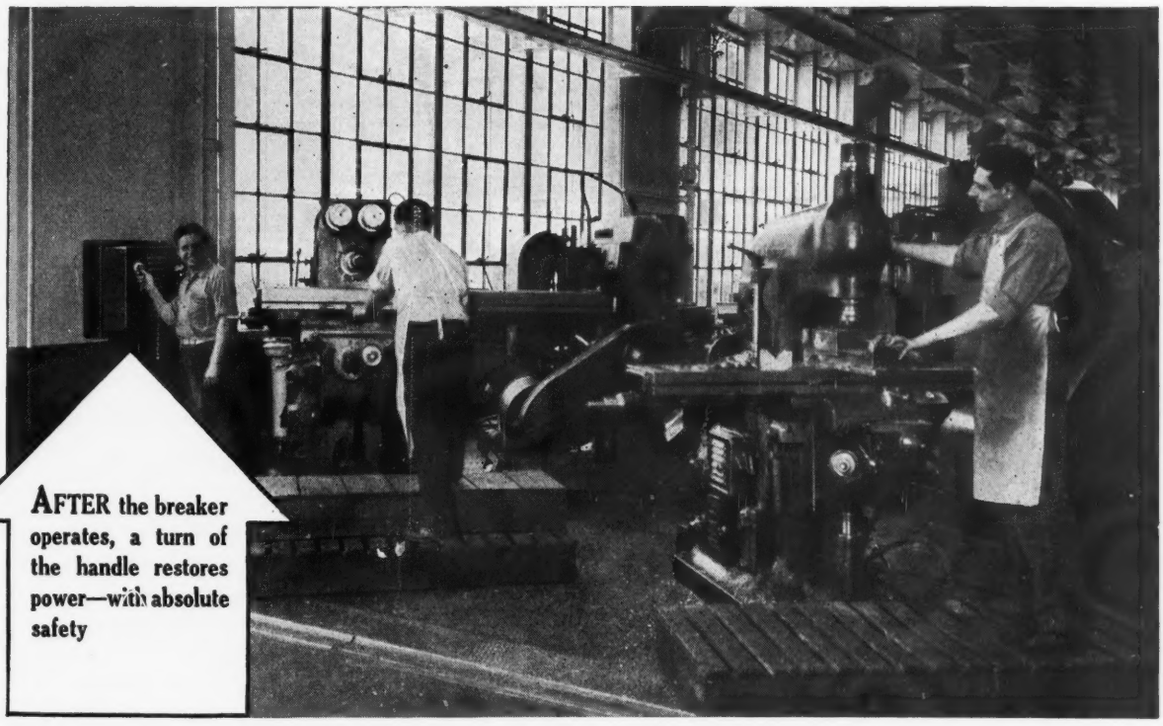
Our Engineering Department will gladly co-operate with you on your boiler problems.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

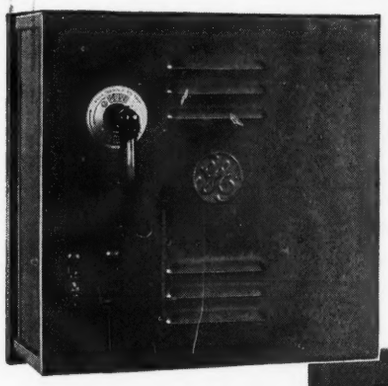
Other Murray Products:

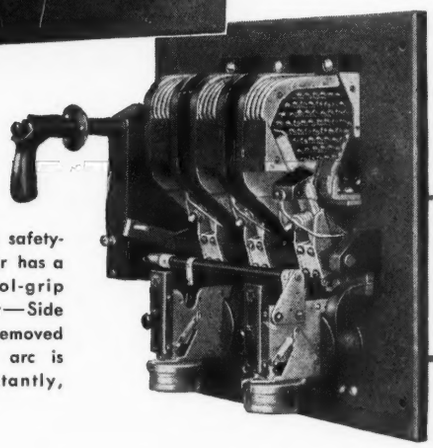
Steam Turbines, Corliss and 4-Valve Engines, Turbine Driven Unit Heaters, Grey Iron Castings

TODAY—BRANCH FEEDERS SHOULD BE PROTECTED WITH AIR CIRCUIT BREAKERS



AFTER the breaker operates, a turn of the handle restores power—with absolute safety





The Type AE-1A safety-enclosed breaker has a convenient pistol-grip handle. At right—Side of arc quencher removed to show where arc is smothered instantly, safely

3-phase interruption prevents motors from running single-phase, reduces repair expense, and avoids delay

PROVISION for the increased use of electricity in industrial plants has in many cases raised the possible short circuits to such a magnitude that air circuit breakers are now necessary for adequate protection of the main and branch feeders.

The Type AE-1 safety-enclosed air circuit breakers are admirably adapted to furnishing adequate protection against dangerous short circuits. Also, they provide three-phase interruption in case of dangerous over currents. Service is restored immediately by a slight movement of the handle. They are safety-enclosed for the protection of personnel. Reliable arc quenchers interrupt quickly and confine the arc. Dependable protection of cables, motors and other apparatus is assured.

In the photograph you see a workman reclosing the opened circuit by turning the pistol-grip handle—no production delays here. This feature alone means real savings in the long run. Also, a dual overcurrent device provides time-delay overload protection combined with instantaneous tripping on short circuits.

Write for Bulletin GEA-2896. It shows WHY and WHERE air breakers should be used. General Electric Company, Schenectady, New York.

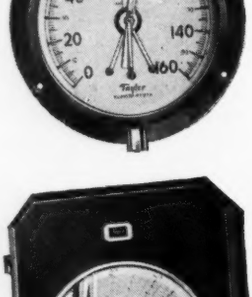
GENERAL ELECTRIC

890-75

Watchmen that warn you of **DANGER!**

▶ **It's a good idea to keep Taylor Instruments, like the ones below, on guard at vital points throughout your plant. With Taylor Instruments you can stop temperature leaks, and keep a constant watch on plant operations that will help you cut future costs.**

WATCHMEN THAT SHOW . . . These Taylor BINOC Industrial Thermometers permit power plant operators to take temperature readings accurately and quickly. The BINOC tubing more than doubles the angle of vision. This new tubing ends squinting. It contains a broader mercury column on which more light is concentrated for quicker reading at longer distances. Why not let a Taylor Representative give an actual demonstration of its advantages in your plant?



WATCHMEN THAT SHOUT . . . When these Taylor Alarm-Equipped Dial Thermometers remain silent—All's Well! But when they burst into noise, then look out—temperatures have gone wrong, and costly equipment may soon be damaged. Taylor Dial Thermometers may be had with Electric-Alarm mechanisms for Rising Temperature, Falling Temperature, or Rising-and-Falling Temperatures. Tough and durable, they can be put to work taking temperatures on oil lines, bearings, generator air-coolers, or other vital temperature points in your plant. And when temperatures get outside proper limits, they'll let you know at once.

WATCHMEN THAT WRITE . . . You can keep a permanent file record of today's temperatures that can help you cut tomorrow's costs if these Taylor Recording Thermometers and Pressure Gauges are in your plant. They keep an accurate, hourly record of vital temperatures that every power plant will find valuable. There are Taylor Recording Instruments of the vapor-, gas- and mercury-actuated types, each designed to meet specific conditions in your plant. A Taylor representative will gladly analyze your needs for you, and recommend the proper temperature system to meet them.

Full information about Taylor Temperature and Pressure Indicating and Recording Instruments designed for power plant use can be had by just writing Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada. Manufacturers in Great Britain—Short & Mason, Ltd., London, England.

Taylor

Indicating | Recording • Controlling

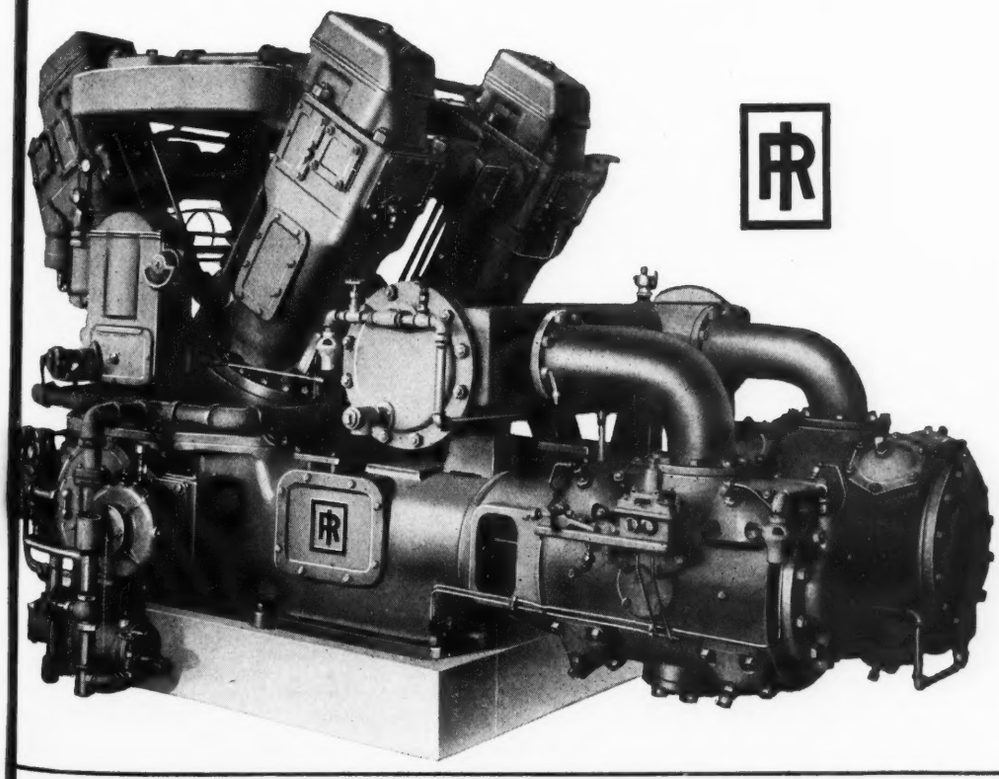
TEMPERATURE, PRESSURE, FLOW *and* LEVEL INSTRUMENTS

933 CU. FT. OF AIR for 1¢

*For every cent spent for fuel oil the XVO will compress 933 cu. ft. of free air to 100 pounds pressure.

*Based on fuel oil at 6 cents per gallon.

The New XVO Diesel-Engine-Driven Compressor



THIS new compressor combines a *heavy-duty, four-cycle Diesel engine* and a *horizontal heavy-duty, double-acting compressor* in a single, compact and comparatively light-weight unit which operates at a moderate speed. High over-all efficiency is the natural result of such a unit. It is the outstanding Diesel-driven compressor of today.

This compressor is built in sizes of 4, 6, or 8 power cylinders, rated respectively at 625, 935 and 1250 cfm. actual free-air capacity at 100 pounds pressure. Compressor cylinders can be furnished for vacuums, for pressures up to 5000 pounds, and for air, gas or ammonia compression.

The frame, running gear and compressor cylinders are the same as for our Type XVG gas-engine-driven unit of which there are more than 125,000 installed horsepower. The fuel and combustion systems of the XVO are the same as those of the Ingersoll-Rand Type S Diesel engine, a pioneer in its field.

The XVO is conservatively rated for 24 hours-a-day, full-load service. When economy dictates the use of Diesel engines, the XVO compressor is the logical choice.

More detailed information on its money-saving features is contained in Bulletin 3072. May we send you a copy?

I-R Products: Compressors, Rock Drills, Pneumatic Tools, Oil Engines, Pumps, Condensers, Refrigerating Units

Atlanta
Birmingham
Boston
Buffalo
Butte
Chicago
Cincinnati
Cleveland
Dallas
Denver
Detroit
Duluth
El Paso
Hartford
Houston
Kansas City

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY 681-1

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Consulting Valuations Reports — Developments Appraisals Construction — Designing Testing Financing — Inspections Cost Analysis Investigations

OLIVER FIELD ALLEN
Licensed Professional Engineer New York State
Fellow: A.I.E.E. Member: A.S.M.E., S.A.E.
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Diesel Engines, International Engineering Liaison.
Gas and Oil Engine Power Applications.
Regular Foreign Correspondent.
117 Liberty Street, New York City
Cable Address: OFALL-New York

HALL LABORATORIES, Inc.
R. E. Hall, Ph. D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. Pittsburgh, Pa.

SARGENT & LUNDY
INCORPORATED
ENGINEERS
140 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS

THE power plant executive who, with the help of sound engineering council, carefully scrutinizes every department of the plant with the result in mind of being thoroughly modern as to materials, equipment, operating methods, maintenance and management—that man is headed in the right direction.

FRANCIS J. SILL
HEAT and POWER ENGINEERING
as applied to Industrial Plants
Test—Reports—Design—Construction
Westboro, Massachusetts

JOHN A. STEVENS, Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
Lowell, Massachusetts

THE J. G. WHITE ENGINEERING CORPORATION
ENGINEERS—CONSTRUCTORS
Steam and Hydraulic Power Plant Design and Construction, Investigation and studies of Power and Steam Problems.
Reports and Appraisals
80 Broad St., New York

POSITIONS WANTED

STATIONARY ENGINEER all round experience, good mechanic, go anywhere. PW-844, Power, 330 W. 42nd St., New York, N. Y.

COLLEGE GRADUATE. Age 33. Two years training in all phases of pulverized coal. Eight years experience in design, supervision and operation of steam power plants—all fuels. In present employment eight years as Combustion Engineer. Desires position in industrial power plant as Ass't or Chief Engineer. PW-846, Power, 330 W. 42nd St., New York, N. Y.

CHIEF ENGINEER in a small steam power plant or operator in a large one. Age 32, married, references. Will go anywhere. PW-850, Power, 520 N. Michigan Ave., Chicago, Ill.

DIESEL OPERATOR (32) available as assistant in large plant or in charge of small one. Experienced in both operation and maintenance—2 years on marine work. Resident technical school certificate. PW-832, Power, 330 West 42nd Street, New York City

EMPLOYMENT SERVICE

SALARIED POSITIONS. $2,500 to $25,000. This thoroughly organized advertising service of 29 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 260 Delward Bldg., Buffalo, N. Y.

CHICAGO REPRESENTATION
Established Engineering Sales Organization now handling Power Plant Equipment on commission basis, contacting Industrials, Utilities, Contractors, and Consulting Engineers in middle west states, desires an allied line of equipment.
RA-852, Power,
520 No. Michigan Ave., Chicago, Ill.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : BUSINESS : **"OPPORTUNITIES"** : EQUIPMENT : USED OR RESALE

UNDISPLAYED —— RATES —— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only) ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $6.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured vertically on a column—3 columns—30 inches to a page. Contract rates on request.

SELLING OPPORTUNITIES OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

REFRACTORY CONSTRUCTION. Established company engaged in manufacture of Refractory Specialties and construction of boiler settings, special furnaces, etc., including suspended arches, suspended air cooled walls and suspended insulated walls has available for exclusive distribution some excellent territories. Salary and commission arrangements or liberal straight commission arrangements can be made. When writing give full references and full particulars regarding sales experience and technical qualifications. RW-851, Power, 520 N. Michigan Ave., Chicago, Ill.

Exclusive Sales Representation
Wanted in Southern and Western Territories by an old established Company, manufacturing equipment for power plants, offering attractive commissions to establish engineering sales organization. When writing give full particulars as to experience and qualifications. References required.
RW-853, Power
330 West 42nd St., New York City

FREE BULLETINS

STOCK LIST #85, 24 pages, 4x9¼", classified, indexed and illustrated. Saddle stitched. Write to Moorhead-Reitmeyer Co., Inc., 4th Avenue & Wood Street, Pittsburgh, Pa.

CLASSIFIED Stock Summary. 21 pages, 5¼x8½". Classified and indexed. Saddle stitched. Write to Mr. T. K. White, Apparatus Exchange, Ebasco Services, Inc., 2 Rector St., New York City.

ELECTRIC Motors & Generators. Stock List A-38. 32 pages, 4"x8¾", classified, illustrated and indexed. Write L. J. Land, 144 Grand St., N.Y.C.

Bulletin #116 of Industrial, Power Plant & Construction Equipment. 15 pages, 3½ x 8", Classified and illustrated. Write to Mississippi Valley Equipment Co., 511 Locust St., St. Louis, Mo.

Equipment Wanted—see page 139

New "SEARCHLIGHT" Advertisements
must be received by December 21st to appear in the January issue.
Address copy to the Departmental Advertising Staff
Power
330 West 42nd St., New York City

THE FINEST REBUILT EQUIPMENT MONEY CAN BUY

Ready For Immediate Shipment

Teletype Designation Union City, N. J. 1750

CHICAGO REP. HOWARD B. JOHNSON, 53 W. JACKSON BLVD.

MOTOR GENERATOR SETS

1—500-kw., 600-V., General Electric, synchronous.
3—600-kw., 250-V., General Electric, synchronous.
1—300-kw., 250/125-V., G.E., synchronous.
1—200-kw., 600-V., Westinghouse, synchronous.
1—200-kw., 125-V., G.E. Synchronous.
1—175-kw., 250-V., G.E., Synchronous.
1—150-kw., 250-V., Westinghouse Synchronous.
2—100-kw., 125-V., G.E., Sq. Cage.
1—100-kw., 125-V., G.E. Synchronous.
1—100-kw., 250-V., Westinghouse Synchronous.
1— 75-kw., 125-V., Crocker-Wheeler Synchronous.
1— 75-kw., 250-V., G.E., Synchronous.
1— 50-kw., 125-V., G.E. Sq. Cage.
1— 50-kw., 250-V., G.E. Sq. Cage.
200-kw., 250-V., G.E. Synchronous.
25-kw., 125-V., Allis-Chalmers, Sq. Cage.

TURBINES

1—500-kw., General Electric, 3 phase, 60 cycle, 480 volt bleeder.
1—400-kw., General Electric, non-condensing.
1—156 kva., Westinghouse, non-condensing.
2—100 kw., Westinghouse, 220 volt, 3 phase, 60 cycle non-condensing.
1—62½ kva., Allis Chalmers-Kerr, 3 phase, 60 cycle, 220 volt.
1—50 KW, 125 volt, G.E.-Kerr.

TRANSFORMERS

1—400-kva., G.E. 2400/240-480 volts.
3—300-kva., 3-ph., Pittsbg. 4800/2400/240/120-V.
4—300-kva., Pittsburgh, 4600/115/230 volts.
4—200-kva., Pittsburgh, 7800/220/110 volts.
3—200 KVA, General Electric, 6600/230/460 volts.
2—150-kva., Westinghouse, 2300/230/115-V.
3—150-kva., Pittsburgh, 6600/440 volts.
3—150-kva., Pittsburgh, 2200-220/110 volts.
3—100-kva., Pittsburgh, 2200-220/110 volts.
3— 75-kva., General Electric, 6600/2300-240 v.
3— 75-kva., G.E., 2300/230/115 volts.
5—25-kva., Westinghouse Air Cooled, 440/220/220/110 V.
1—25-kva., G.E., 440/110-V.
1—25-kva., G.E., 220/220/110-V.
4—21-kva., G.E., 440/110-V.
2—20-kva., Westinghouse, 440/220/110-V.
3—15-kva., G.E., 440/120-V.
4—15-kva., Westinghouse Air Cooled, 220/440/220/110-V.
1—10-kva., G.E., 440/220/110-V.

SPECIALS

2—3000 ampere, 15,000 volt, General Electric solenoid operated, oil circuit breakers.
1000/500 ampere, 5/10 volt, General Electric plating motor generator set.
1—350 H.P., 100 RPM, General Electric synchronous motor.
1—75 KW, 220/440 volt, Vertical Engine Generator Set.
1—200 H.P., Westinghouse, type SK, 500 RPM, 550 volt motor.

A.C. GENERATORS

720-kva., 514 r.p.m., 4000/2300-V., G.E. Syn. Condenser.
1—600-kva., 900 RPM, General Electric, 2300 volt, synchronous condenser.
1—500-kw., General Electric, 550 volt, 3600 r.p.m.; direct connected exciter.
1—500-kw., Westinghouse, 220/440 volt, 450 r.p.m.
1—400-kva., Westinghouse, 220/440 volt, 400 r.p.m.
1—375-kw., Westinghouse, 2300 volt, 240 r.p.m.
1—200-kw., Allis Chalmers, 220 volt, 3600 r.p.m.; direct connected exciter.
150-kw., 450 r.p.m., 220-V., Westinghouse.
100-kw., 900 r.p.m., 220-V., G.E.
75-kva., 300 r.p.m., 2400-V., Westinghouse.
75-kva., 1200 r.p.m., 2300-V., G.E.
50-kw., 300 r.p.m., 2300-V. G.E.
42-kva, 1200 r.p.m., 2400-V., Elec. Machy.
2—7½-kw., 1800 r.p.m., 240-V., G.E.

D.C. MOTORS—230 Volts

1—240-hp., 550 r.p.m., G.E.
1—215-hp., 750 r.p.m., G.E.
1—125 hp., 850 r.p.m., G.E.
1—100-hp., 950 r.p.m., G.E.
1—100-hp., 900 r.p.m., G.E.
1— 80-hp., 490 r.p.m., G.E., series wound.
1— 60-hp., 1050 r.p.m., G.E.

D.C. GENERATORS

1—500-kw., 900 r.p.m., 250-V., General Electric.
1—250-kw., 200 r.p.m., 125/250-V., Crocker Wheel.
1—100-kw., 750 r.p.m., 125-V., G.E.
1—100-kw., 600 r.p.m., 125/250-V., G.E.
2— 75-kw, 1200 r.p.m., 125-V., Crocker Wheeler.
1— 75-kw., 550 r.p.m., 50-V., G.E.

MOTORS—3 PHASE, 60 CYCLES

No.	H.P.	R.P.M.	Volts	Type
1	500	450	2200/4000	G.E., Sl. Rg.
1	400	600	440	G.E., Sl. Rg.
1	350	450	440	G.E., Sl. Rg.
1	300	720	440	G.E., Sl. Rg.
1	240	720	220	G.E. Syn.
1	200	600	440	G.E., Sq. Cg.
2	200	514	220/440/4000	G.E. Syn.
4	200	450	2200/4000	G.E., Sl. Rg.
2	200	514	2200/4000	G.E., Sl. Rg.
1	150	600	2200	G.E., Sl. Rg.
1	150	900	440	G.E., Sl. Rg.
2	150	1160	440	G.E., Sq. Cg.
1	150	1160	440	West. Sl. Rg.
1	150	1730	2200	G.E. Sq. Cg.
1	125	900	440	G.E. Sl. Rg.
1	100	1200	440	G.E. Sl. Rg.
1	100	720	440	West. Sl. Rg
1	100	1800	440	Al.-Ch. Sq. Cg.
1	79	1160	440	G.E. Sl. Rg.
1	75	1800	2200	G.E. Sq. Cg.
1	75	900	4150	Elec. Machy. Syn.

Variable Speed 230 Volt Motors

H.P.	R.P.M.	Type
200	275/550	G.E.
1—150	300/900	Westinghouse
125	475/950	Westinghouse
90	470/940	G.E.
75	235/950	Burke
60	600/1200	G.E.
50	400/1200	G.E.
35	500/1500	G.E.
35	500/1250	G.E.
30	600/1200	West.
30	225/900	Cr. Wheeler
20	750/1500	G.E.
20	400/1200	G.E.
4— 20	300/1200	G.E.
3— 15	300/1200	G.E.

J. L. HEMPHILL & CO., INC. 801 Williams St., No. Bergen, N. J.

NEW YORK LINE LONGACRE 5-3227 **N. J. TEL. PALISADE 6-2600**

The Pick of Power Equipment

AC-DC UNAFLOW ENGINE GENERATOR UNITS

1—770 KVA, 60 cycle Skinner
1—450 KVA, 60 cycle Skinner
2—375 KVA, 60 cycle Skinner
1—312 KVA, 60 cycle Skinner
1—250 KVA, 60 cycle Skinner
1—500 KW, Skinner, 125 volts
1—300 KW, Harrisburg, 250 volts
1—125 KW, Skinner, 125 volts

A.C. OIL ENGINE UNITS 60 CYCLE

2—1000 KVA DeLaVergne 2300/460/230 V.
1— 600 KVA Winton 240/480 V.
1— 375 KVA Worthington 2300/440/220 V.
1— 343 KVA Ing.-Rand 2300/440/220 V.
2— 250 KVA Worth. 4 cy. 2300/460/230 V.
1— 87½ KVA Worth. 2300/460/230 V.
1— 60 KVA Fair.-Morse 2300/460/230 V.
1— 47½ KVA Cummins, 240 V.

SPECIAL—3—760 HP B & W 200# ASME BOILERS BUILT 1926

PARTIAL LIST ONLY

30 Years of National Service

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY

—TRANSFORMERS—

A Complete Stock. **Prompt Shipment.**

3—1000 KVA Gen. Electric Transformers, 2300-230/460 volts, 60 cycle..... **$1400.00** Each

We Rewind, Repair and Redesign all Makes and Sizes.
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR.
Write for Catalog No. 133-F

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M **SINCE 1912** **CINCINNATI, OHIO**

PRICED TO SELL

360 HP **Fairbanks Morse Diesel engine** in excellent condition. Can supply generator if desired.
1—2000 KW, 3 ph., 60 cy., **G.E. turbo gen. cond.**
1—1500 KW, 3 ph., 60 cy., **G.E., turbo gen. cond.**
1—1500 KW, 3 ph., 60 cy., **G.E., turbo gen., non-condensing**
1— 400 KW, 3 ph., 60 cy., **Allis to Kerr, non-condensing**
1— 300 KW, 3 ph., 60 cy., **Westgh., condensing**
1— 250 KW, 250 V., D.C. **Gen. Elec. turbo gen.**
1—2000 sq.ft. **Worthington surface condenser**
1—3000 sq.ft. **C. H .Wheeler surface condenser**
1— 600 KVA, 575-480 V., 400 rpm, 3 ph., 60 cy., **G.E. generator**
1— 325 KVA, **Allis**, 3 ph., 60 cy. to Skinner unaflow
1— 250 KVA, **Allis-Chalmers**, 3 bearing generator
1— 180 KVA, **G.E.**, A.C. to Ames 4 valve engine
1— 156 KVA, **Allis**, 60 cy. to Skinner unaflow
1— 120 KW, **G.E.**, 60 cy. to Ames, 4 valve engine
1— 80 KW, **G.E.**, 60 cy. to Hewes & Phillips, 4 valve
2—100 KVA, 3 ph., 60 cy., 900 rpm, **Westgh. gen.**
Number of other sizes
1—150 KW, 250 V., D.C. to Skinner unaflow
1—300 KW, 250 V., **Westgh.** to 430 HP, 3 ph., 2300 V. motor syn.
1—300 KW, 250 V., **G.E.** to 800 HP, 2 ph., 2300 V. motor syn.
1—150 KW, 250 V., **G.E.** to 225 HP, 440-550 V. motor syn.
1—150 KW, 250 V., **G.E.** to 240 HP, 2300 V. motor syn.
1—150 KW, 250 V., **Ridgway** to 225 HP, 2200 V. motor syn.
1—125 KW, 125 V., **G.E.** to 190 HP, 550 V. motor syn.
1—100 KW, 250 V., **Ridgway** to 150 HP, 2200 V. motor syn.
1—100 KW, 250 V., **Gen. Elec.** to 150 HP, 440 V. G.E. motor
1—65 KW, 125 V., **G.E.** to 100 HP, 440 V., G.E. motor
1—50 KW, 250 V., **Westgh.** to 440 V. motor
1—50 KW, 125 V., **G.E.** to 220/440 V. motor
1—15 KW, 250 V., **Westgh.** to 220/440 V. motor
2—75 KW, 250 V., 6 ph., **Gen. Elec. rotaries** with transformers

Large Stock of Motors, Transformers, Etc.
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Philadelphia Transformer Co., Inc.
2829 Cedar St. **Phila., Pa.**

L MOTORS AND GENERATORS

Partial Listing

250 VOLT GENERATORS

250 K.W. Ridgway Belted Generator, 500 RPM, 2 bearing, suitable for Diesel Engine drive.
175 K.W. Westgh. Synch. Motor Generator Set, 3 bearing, 3 ph., 2300 v.
150 K.W. Ridgway Synch. Motor Generator, 250 v., direct current, Motor 3 ph., 60 cy., either 220 or 440 v.
100 K.W. G.E. 250 v., direct current, 3 ph., 60 cy., 2300 v.
100 K.W. Ridgway Synch. Rotary Converter, 250 v., direct current, 4150Y 2300 v., 3 ph., 1200 RPM.
30 K.W. Westgh. 250 v., direct current generator 4 bearing unit, latest type, sealed sleeve bearing.

250 V. D.C. VARIABLE SPEED MOTORS

35 H.P. G.E., RF13, 500/1500 RPM.
30 H.P. G.E., LC 825/2000 RPM.
20 H.P. G.E., RF 500/1500 RPM.
15 H.P. Westinghouse, SK 825/1650 RPM.
15 H.P. G.E., RLC 600/1800 RPM.
15 H.P. G.E., RF 400/1200 RPM.
12½ H.P. G.E., RLC 500/1500 RPM.

230 VOLT D.C. HOISTS

6 Ton Yale & Towne Cable Hoist.
4 Ton G.E. Sprague slow speed hoist suitable for foundry work.
3 Ton Franklin Moore Cable Hoist.
1 Ton Shepard Cable Hoist.
500 lb. American Cable Hoist

A.C. HOISTS—3 Phase

3 Ton Shepard Electric Cable Hoist.
3 Ton American type H3 Cable Hoist.
2 Ton American Cable Hoists type B2 (2).
2 Ton Detroit Electric Cable Hoist.
1 Ton Detroit Cable Hoist.
½ Ton Franklin Moore Cable Hoist.

SYNCHRONOUS MOTORS

350 H.P. Ridgway High Torque 900 RPM, 3 phase.
175 H.P. G.E. 600 RPM, 3 phase.
150 H.P. G.E. 1200 RPM, 3 phase.
110 H.P. G.E. 900 RPM, 3 phase.
75 H.P. G.E. 1200 RPM, 3 phase.
60 H.P. G.E. 1200 RPM, 3 phase.

A.C. GENERATORS

200 K.W. G.E., 720 RPM, 3 phase.
150 K.W. Allis-Chal. 900 RPM, 3 phase.
150 KVA. Crock Wheel. 900 RPM, 3 ph.
150 K.W. G.E. 900 RPM, 3 phase.
90 KVA. Triumph 360 RPM, 3 phase.
75 KVA. Westgh., 900 RPM, 3 phase.
50 KVA. Westgh., 1200 RPM, 3 phase.
37½ KVA. G.E. 1200 RPM, 3 phase.
25 KVA. 1200 RPM, 3 ph., 220/440 v. (11).
15 KVA. 1200 RPM, 3 ph., 220/440 v. (9).

WELDERS

400 ampere Lincoln shield-arc latest type.
500 ampere Westinghouse multiple operator motor driven welding generator, in use with individual operator re-actor panels.

SLIPRING & SQUIRREL CAGE MOTORS

250 H.P. Fairbanks Morse slipring 600 RPM, 3 bearing, ball bearing.
220 H.P. Crocker Wheeler squirrel cage 720 RPM.
150 H.P. General Electric 600 RPM squirrel cage.
150 H.P. Gen. Elec. slipring 720 RPM.
112 H.P. General Electric slipring hoist duty 720 RPM.
100 H.P. Allis-Chalmers 1200 RPM squirrel cage
75 H.P. General Electric 1800 RPM squirrel cage.

MISCELLANEOUS

15 K.W. to 50 K.W. Frequency Changers 90, 100 and 120 cycle (12).
12½x12 American plate valve compressor, 390 cubic feet 125 lbs. pressure complete.
10 KVA Static Transformer 100,000/50,000 volts.

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3 PHASE 60 CYCLE 240/480/600/2400 VOLTS

1563 KVA General Electric AUTOMATIC EXTRACTION, 150-200 lbs. steam pressure, 0-30 lbs. extraction pressure.
940 KVA Westinghouse condensing, 150-200 lbs. steam pressure, 525 deg. TT.
625 KVA Westinghouse condensing, 150-200 lbs. steam pressure 525 deg. TT.
375 KVA Westinghouse noncondensing, 100-200 lbs. steam pressure 0-15 lbs. back pressure.

ENGINE GENERATOR SET

3 PHASE 60 CYCLE

438 KVA General Electric-Murray uniflow 135-175 lbs. steam pressure, 0-15 lbs. back pressure; 240-480-600-2400 volts.

DIESEL GENERATOR UNIT

3 PHASE 60 CYCLE

300 KVA Fairbanks-Morse Full Diesel style VA 240/480/600/2400 volts.

MOTOR GENERATOR SETS

600 KW Allis-Chalmers synchronous, 250 volts, D.C.; 3 phase 60 cycle 2300 volts A.C., 900 RPM.
150 KW General Electric synchronous, 250 volts, D.C.; 3 phase 60 cycle 2300 volts A.C., 900 RPM.
100 KW Westinghouse synchronous, 250 volts D.C.; 3 phase 60 cycle 220-440 volts A.C., 1200 RPM.

ROTARY CONVERTER

200 KW Westinghouse compound wound interpole 250 volts D.C.; 2 or 3 phase 60 cycle, 1200 RPM, with 440 volt transformers.

This is a partial list. Send us your inquiries!

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Synch. Motor Generators

750 KW WEST., 250 D.C., 2300 A.C., 900 RPM
500 KW AL-CH., 250 D.C., 2300 A.C., 900 RPM
300 KW G.E., 250 D.C., 2300/4000 A.C., 1200 RPM
250 KW G.E., 250 D.C., 220/440 A.C., 720 RPM
200 KW G.E., 550 D.C., 2300/4000 A.C., 1200 RPM
200 KW G.E., 250 D.C., 2300/4000 A.C., 1200 RPM
150 KW G.E., 250 D.C., 2300 A.C., 1200 RPM

Synchronous Converters

300 KW G.E., 250 D.C., 2300/4000 A.C., 1200 RPM
200 KW G.E., 250 D.C., 2300/4000 A.C., 1200 RPM
200 KW RW, 250 D.C., 2300/4000 A.C., 1200 RPM
150 KW RW, 250 D.C., 2300/4000 A.C., 1200 RPM

(All of the above units are complete with necessary switchboards.)

WALLACE E. KIRK COMPANY

INCORPORATED

Grant Building Pittsburgh, Pa.

SELF CONTAINED ASME BOILERS

1—210 hp. Stanwood Smokeless, 125 lb.
1—100 hp. Leffel Scotch, 125 lb.
1— 50 hp. Ames Empire, 125 lb.
1— 30 hp. Ames Empire, 100 lb.

Regular Steam Fixtures

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ELECTRIC MOTORS
AIR COMPRESSORS

DELTA EQUIPMENT CO.

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A. C. UNIFLOW SET

1—150 KW Burke Generator 2300 volt, 60 cycle, 200 RPM D.C. to Skinner Uniflow horizontal engine. Non-condensing. Will furnish for any 2 or 3 phase voltage. NEW 1929

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Pittsburgh, Pennsylvania

1—625 KVA **G.E. Turbo Generator** 60 cycle, 3 phase, 2300 volts, with condenser and intermediate piping, circulating and condensate pumps.

1—200 KVA **Westinghouse Generator**, 240 V., 3 phase, 60 cycle, direct connected to 16x30 Hamilton engine.

1—400 H.P. 3-drum **Titusville Boiler**, 160# pressure, used less than 3 years.

PENN ELECTRICAL ENGINEERING CO.

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1—500 H.P.

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MOTORS ALL TYPES — **GENERATORS** — **CONTROLS** — **TRANSFORMERS** — MOTOR GENERATOR **SETS**

60 Cycle—3 Phase—Slip Ring Motors

HP	Make	Voltage	Speed
75	Gen. Electric	440	1200
100	Westinghouse	550	690
150	Westinghouse	440	514
150	Westinghouse	550	580
150	Westinghouse	440	600
175	Ideal	2200	1750
200	Westinghouse	440	900
300	Gen. Electric	440	900

60 Cycle—3 Phase—Synchronous Motors

	50—Gen. Electric	440	327
	100—Gen. Electric	440	360
	Stators and Rotors only with full automatic Gen. Electric Reduced Voltage Starting Compensators and M. G. Sets		
125	Fairbanks-Morse	220	1200

60 Cycle—3 Phase—Sq. Cage Motors

75	Allis Chal.	2200	1750
75	Westinghouse	2200	1750
100	Allis Chal.	440	680
100	Gen. Electric	440	450
150	Westinghouse	440	580
200	Allis Chal.	2200	1160
200	Gen. Electric	4100	600
200	Gen. Electric	440	495
250	Gen. Electric	2300	400

60 Cycle—2 Phase—Sq. Cage Motors

150	Burke	440	900

60 Cycle—3 Phase—Alternators

75	KVA	Triumph	440	900
90	KVA	F. & M.	220	1200
100	KVA	G. E.	240	900

D.C. Motors

HP	Make	Voltage	Speed
40	Gen. Elec.	230	860
40	Gen. Elec.	230	700/1000
50	G.E. Sprague	230	650/1000
60	Gen. Elec.	230	650
75	Westinghouse	230	1200
100	Northwestern	230	1750
100	Reliance	230	1100
100	Westinghouse	230	1200

Direct Current Generators

50	KW	Northern	125	750
75	KW	Gen. Elec.	250	300

25 and 60 Cycle MG Sets

35 KW Gen. Elect. DC Generator, 125 volts, Conn. to 50 HP. 220 V. 25 cy. 1500 RPM motor.
50 KW Westinghouse, 125 Volts D.C. Direct Conn. to Westinghouse 440 Volts, 25 Cycle, 750 speed motor.
100 KW Gen. Elec. DC Generator, 125 V., Conn. to 150 HP SC Motor, 220 V., 25 cy., 500.
100 KW Gen. Elec. DC Generator, 125 Volts Conn. to 150 HP SC Motor, 220 V., 60 cy., 600 Speed.
200 KW Allis-Chalmers, DC 115 volt Generator, Conn. to 300 HP Allis-Chalmers synchronous, 4000 volt, 25 cycle motor.

ENGINE GENERATOR SET

57 KW Allis Chalmers, DC, 120 volts, 275 RPM, direct connected to Ridgeway Horizontal Engine.

Cumming Diesel connected to 35 KW Gen. Electric, type A.T.B. 3 phase, 60 cycle, 220 volts, 1200 speed Generator
Cumming Diesel connected to 50 KW General Electric type A.T.B. 3 phase, 60 cycle, 220 Volts, 1200 Speed Generator. Complete control including Voltage regulator for above

SPECIAL—LOW PRICE

Lakewood—6000 lbs. Electric Locomotive, 96 volts, type 3324 (36 inch guage) complete with batteries, 6 cars, Westinghouse Motor Generator Set and charging panel

Transformers

1—25 KVA, G.E. type H, 1 phase 25 cycle, 13,200-2300-4000 volts.
3—75 KVA Pittsburgh, 1 phase, 60 cyc. 13,200-2300 v.
3— 75 KVA West., type St., 3 phase, 440-110-220 v.
6—100 KVA G.E. 2300-440-220-110 volt, 25 cycle.

25 Cycle—3 Phase—Slip Ring Motors

HP	Make	Voltage	Speed
100	Gen. Elect.	440	750
100	Wagner	440	750
100	Gen. Elec.	440	350
150	Gen. Elec.	2200	500
150	Gen. Elec.	440	500
200	Gen. Elec.	440	500
200	Westinghouse	440	485
250	Gen. Elec.	220	375

25 Cycle—3 Phase—Sq. Cage Motors

100	Gen. Elec.	440	750
100	Allis Chal.	440	480
100	Westinghouse	440	480
100	Gen. Elec.	220	730
125	Allis Chal.	440	480
150	Crocker Wheel.	2300	720
200	Allis Chal.	440	480
250	Allis Chal.	440	480
300	Westinghouse	440	720

25 Cycle—3 Phase—Alternators

120	KVA	Gen. Elect.	440	750
150	KVA	Elec. Mchy.	440	750

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY—ROCHESTER, N. Y., OR TOLEDO, OHIO, SHIPMENT. REBUILT EQUIPMENT SOLD WITH STANDARD NEW GUARANTEE. WE BUY USED EQUIPMENT, 25 AND 60 CY. SEND US YOUR OFFERINGS.

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2500 KW PRACTICALLY NEW TURBINE SETS

2—2500 KW, 80% P. F. Allis-Chalmers 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbo generator sets, with surface condensers and auxiliaries. Suitable for 250 lbs. pressure, 500° TT. Operating inspection. Immediate delivery.

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1—2000 cu ft **Wor.** St. Dr. 90# air.
1—7000 cu ft **A-C** St. Dr. 90# air.

STEAM PUMPING ENGINES

1—**Wor. Cr.** Com. C&FW 1½ mgd Meyer Valve Gear.
1—**A-C** 4 mgd C&FW Cr. Com. Opp. Type Cond. 12-28x13x24.
1—**Snow** 6 mgd C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36.

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300 KW **Skinner Uniflow** 480 or 2300 volt. Side crank. #10415. Used nominally. Good condition.
2—500 KW **Skinner** 26x36" **Uniflow**, 250 v. DC.
200 KW **Chuse** 4 valve 250 volt DC generator set.
780 HP **DeLaVergne** 6 cyl. 500 KW **Diesel Gen.**
225 HP **Buckeye** 187 KVA 2300 v. **Diesel generator**
2—200/240 HP **Frbks.** VA, 170 KVA 440 v. **Diesels.**
48 HP **Cummins** 4 cyl. 1200 rpm **Diesel.** Like new.
25 HP **Fairbanks "Y" Oil Engine.** Only $250.
Diesels. All sizes to 1150 HP—**All Good Makes.**
150 HP **Casey Hedges Scotch Mar. Boiler** retubed.
200 KW to 10000 KW **Steam Turbine Units.**
60, 90, 125 KVA **F-M** 257 & 300 rpm **Generators.**
66 KW **Fairbks.** 250 v DC 257 rpm **Eng. type Gen.**
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1—**Bleeder** 1000 KW Turbo, Direct Current 125/250 V. Condensing.
3—**Babcock & Wilcox,** ASME, 600 HP, 200 lb. Steel Header Boilers.
1—**New** condition 1250 KW Turbo 250 lb. condensing 60-3-2300 V.
1—**New,** 460 HP, 160 lbs, Bent Tube Boiler with water walls, blt 1938.

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DIESEL ENGINE

1—360 HP **Fairbanks-Morse,** type Y, style VA, 6 cylinder, 257 rpm, solid injection type belted engine; fine condition. Can furnish direct coupled generator.

GEORGE SACHSENMAIER CO.
Hegerman & Ashburner Sts., Phila., Pa.

SLIP RING MOTORS, 3-PH., 60-CY.

HP	Volts	Make	Speed
400	220-440	G.E.	900
300	220-440	G.E.	600
300	2200-440-220	G.E.	1200
150	2200-440	Whse.	1800
150	2200-220-440	G.E.	600
100	2200-220-440-550	G.E.	720
100	440-220	G.E.	600
100	220-440	G.E. (M.T.C.)	900
75	220-440	G.E.	1200
60	220-400	G.E.	900
50	2200-440-220	G.E.	1200
50	220-440	G.E.	900

SYNCHRONOUS MOTORS 3-PH., 60-CY.

350	220-440	G.E.	900
300	220-440	G.E.	600
225	2200-3810	G.E. (New)	1800
240	2300-500	G.E.	900
240	2200-440-220	G.E.	600
220	220-440	G.E.	200
200	440-220	G.E.	720
160	2200-550	G.E.	900
120	2200-440-220	G.E.	1200

TRANSFORMERS—60 CYCLE

3—1500 kva., G.E. type H-D, 23000-2300/4000 Y.
3—667 kva., Westghse., 22,000-2400.
3—400 kva., G.E., type H-L 13800-230/460
2—333 kva., G.E., type H-LQT, 2400-240.
3—333 kva., Westghse., 13,200/26400-230-460.
3—300 kva., G.E., type H-DDI, 4400/13,200-440.
3—250 kva., G.E., type H-KD 23000-2300
3—250 kva., Allis-Chal., 2300-230/460.
4—200 kva., Pittsburgh, type OISC, 13200-460.
3—200 kva., Westghse., type SK, 2200-220.
3—150 kva., G.E., type H-KDD, 2300-230-460.
3—100 kva., G.E., type H-KR 6600/13200-2300.
3—100 kva., Westinghouse, 13200-115/230.
3— 75 kva., Packard type A, 2300-460.
3— 50 kva., Pittsburgh, 13800-120/240.
3—37½ kva., G.E., type H-KF, 2300-230/115.

A. C. GENERATORS

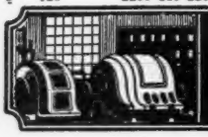
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—225 kva., 900 r.p.m., 2300-550-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.
1—150 kva., 900 r.p.m., 2300-550-V., G.E.
1—112½ kva., 1200 r.p.m., 2200-240-480-V., G.E.
1—112½ kva., 900 r.p.m., 480-240-V., G.E.
1—60 kva., 1200 r.p.m., 240-480-V., Fair.-Morse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440-220	G.E.	IK	1200
220	550	Whse.	CS	720
150	2200-440-220	Whse.	CS	600
150	2200	G.E.	IK	1800
125	220-440	G.E.	KT	720
100	2200-550	G.E.	KT	900
75	220-440	G.E.	KT	900
60	220-440	G.E.	KT	720
60	220-440	G.E.	KT	900
50	220-440	G.E.	KT	900
40	220-440	G.E.	KT	900
20	220-440	Whse.	CS	1800

MOTOR GENERATOR SETS

1—200 kw., 250 V., 1200 r.p.m., Electric Machinery, connected to 233 kva., 2300/4000 V., 60 cy., syn. motor.
1—150 kw., 125 V., 1200 r.p.m., G.E., type MPC compound wound, interpole, direct connected to G.E. type T.S., 225 H.P., 220/440 V., 60 cy. syn. motor.
1—100 kw., 125 V., 1200 r.p.m., Electric Machinery, direct connected to 125 kva., 2300/4000 V., 60 cycle, syn. motor.
1—75 kw., 250 V., 1200 r.p.m., G.E., type RC connected to type ATI, 115 H.P., 2200/440/220 V... 60 cycles, syn. motor.



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45000 KW 60 CY. TURBO
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10,000 & 5,000 KW Turbos 60 cy. 3 ph.
20 T. HAND CRANE 58' SPAN
75 KW 250 V. Turbo with SW.BD.
3—30" VALVES NEVER USED. CRANE #462
33,000 GPM Cent. Pump, 27' hd.
4800'-4300'-1200' Sur. CONDENSERS
1000 & 1565 KVA 60 Cy. Turbos & Cond.
100 TO 1600 HP. OIL ENGS.
100 KW, 60 cy. 3 ph. 240-480 v. Turbo
Large Boilers—200-250#
Boiler Feed Pumps Centrifugal & Steam
312 KVA 60 CY. 3 PH. 4 VALVE ENG. SET
ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

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Lathes; Shapers; Milling Machines; Drills; Pipe & Bolt Threaders; Grinders; Motors; Belting; Welders.
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FOR SALE
GENERATING UNIT
ALLIS-CHALMERS 20"X42" 150 lbs.
Steam Engine Non-condensing, 110 R.P.M.
Releasing Corliss, direct connected to 250 KW, 230-240 Volt Compound Direct Current Generator, Complete with Switchboard.
May be seen in operation.
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VOLTAGE REGULATOR BARGAINS!
TA-125 G.E. Tirrell.....$100.00
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For Sale
M-G SETS
2—G.E. 100 KW—575 Volt M.G. Sets with 2300 volt induction motors complete with starting equipment and switch boards. A-1 operating condition.
TENNESSEE EASTERN ELEC. CO.
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Seamless Steel Boiler Tubes
Used—Hydrostatically tested—free from pitting—Like new—Suitable for retubing
JOS. GREENSPON'S SON PIPE CORP.
National Stock Yards (St. Clair Co.) Ill.

MACHINE TOOLS
Lathes, Shapers, Automatics, Drills, Planers, Milling Machinery, Boring Mills, Grinders, etc.
Large buyers of surplus machine tools and sellers of guaranteed rebuilt metal working machinery—Reliable, dependable.
SUN MACHINERY COMPANY
36 Van Vechten St., Newark, N. J.

GENERATORS — MOTORS
2—**D. C. Generators** class 6-50-290 connected to Harrisburg Engines
1—**D. C. Generator,** class 6-50-290, Fleming Engine
1—**D. C. Generator,** class 6-500-900, Curtis Steam Turbine
6—Type FTR—3 ph. 60 cy. 440 v. 10 HP. **Motors**
3—Type FTR—3 ph. 60 cy. 440 v. 15 HP. **Motors**
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2—Allis-Chalmers 2500 KW, 3/60/6600-v. 200#-500°TT, Condensing—New

2—Westing., 3000 KW, 3/60/2300-v. 200#-500°TT, Condensing

1—General Electric 2000 KW, 3/60/2300-v. Condensing, 200#-100° Superheat, with Surface Condenser

1—General Electric, 1250 KW, 3/60/600-v, 250#550°TT, Non-cond.

1—General Electric 1250 KW, 200#-500°TT, 3/60/2300-v, Condensing.

1—General Electric 1250 KW, 3/60/480-v. Aut. Extraction, 200#-500°, 15-20 lbs. Extr.

1—Allis-Chalmers, 1250 KW, 3/60/480-v. 200#-450°F.TT, Condensing

1—General Elec, 1000 KW, 3/60/2300-v. 175#, 10# Back Pressure, Non-cond.

1—Allis-Chalmers 750 KW, 3/60/2300-v, 250#-550°TT, Condensing: Surface Condenser

1—General Electric, NEW, 750 KW, 3/60/2300-v. 250#-600°F.T.T., Mixed Pressure Condensing

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2	5	1200	220/440	G.E. & Bissell Sq. Cg.
2	7½	1800	220/440	Ideal & West. Sq. Cg.
2	7½	1200	220/440	Howell Sq. Cg.
1	7½	1200	220/440	Lincoln Sq. Cg.
1	10	1800	220/440	G.E. Sq. Cg.
1	15	1200	220/440	Howell Sq. Cg.
1	20	1800	220/440	G.E. Sq. Cg.
1	20	1800	220/440	Lincoln Sq. Cg.
1	25	1200	220/440	G.E. Sq. Cg.
1	30	3600	220/440	Allis-Chal. Sq. Cg. B.B.
1	75	1200	220/440	G.E. Sq. Cg.
1	150	720	220/440	G.E. Sq. Cg.

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12	3	1200	220/440	3 Phase-60 Cycle
19	3	1800	220/440	3 Phase-60 Cycle
17	5	1200	220/440	3 Phase-60 Cycle
20	5	1800	220/440	3 Phase-60 Cycle
5	7½	1200	220/440	3 Phase-60 Cycle
11	7½	1800	220/440	3 Phase-60 Cycle
2	10	1200	220/440	3 Phase-60 Cycle
5	10	1800	220/440	3 Phase-60 Cycle
4	15	1800	220/440	3 Phase-60 Cycle
2	20	1800	220/440	3 Phase-60 Cycle
1	25	1800	220/440	3 Phase-60 Cycle

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Lima, Ohio

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1 Used 1,250 K.W., 25 cycle, 550 volt, 3 phase Engine Driven Generator. Non-condensing.

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STEEL TUBES or FLUES
All sizes, including STERLING (3¼").
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All sizes but especially now, 1½"
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BOILERS

Five to seven 500 to 800 HP Sterling, 4-drum water-tube boilers, B & W preferred. Boilers must not be over 10 years old. They must pass a rigid inspection for 150# operating pressure, and must be built according to ASME Code. Prefer price f.o.b. cars point of location.

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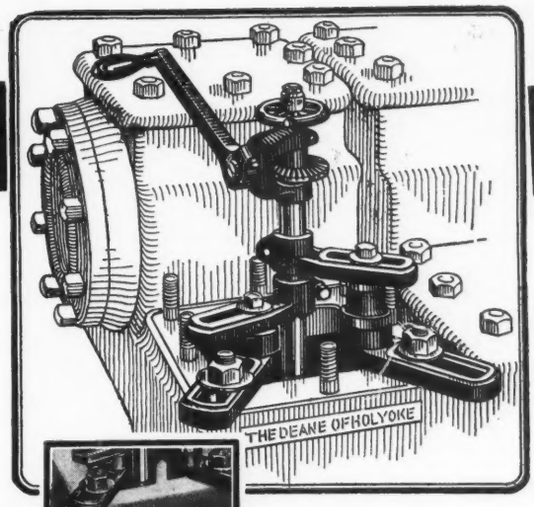

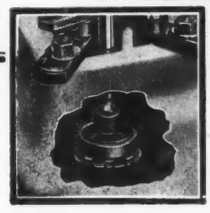

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Don't delay pump valve reseating just because you feel you can't take a pump out of service long enough to do the job.

With a Dexter Outfit you can get a pump back in operation in a jiffy, because you can reface pump seats right in place. By reseating *NOW* with a Dexter, you'll avoid long, costly shut downs and expensive replacements. Then, too, you'll save money in operation, because a Dexter Reseating job puts new life in your pumps, restoring efficiency, saving power and fuel.

The Dexter Machine is easy to use. Just bolt it to the valve chamber studs, rotate the cutter a few turns and the job is done—quickly and at low cost.

Dexter equipment is available for reseating valves of all kinds. Get full information today.

(Our power plant equipment also includes the nationally known Swendaman Automatic Separator. Write for details).

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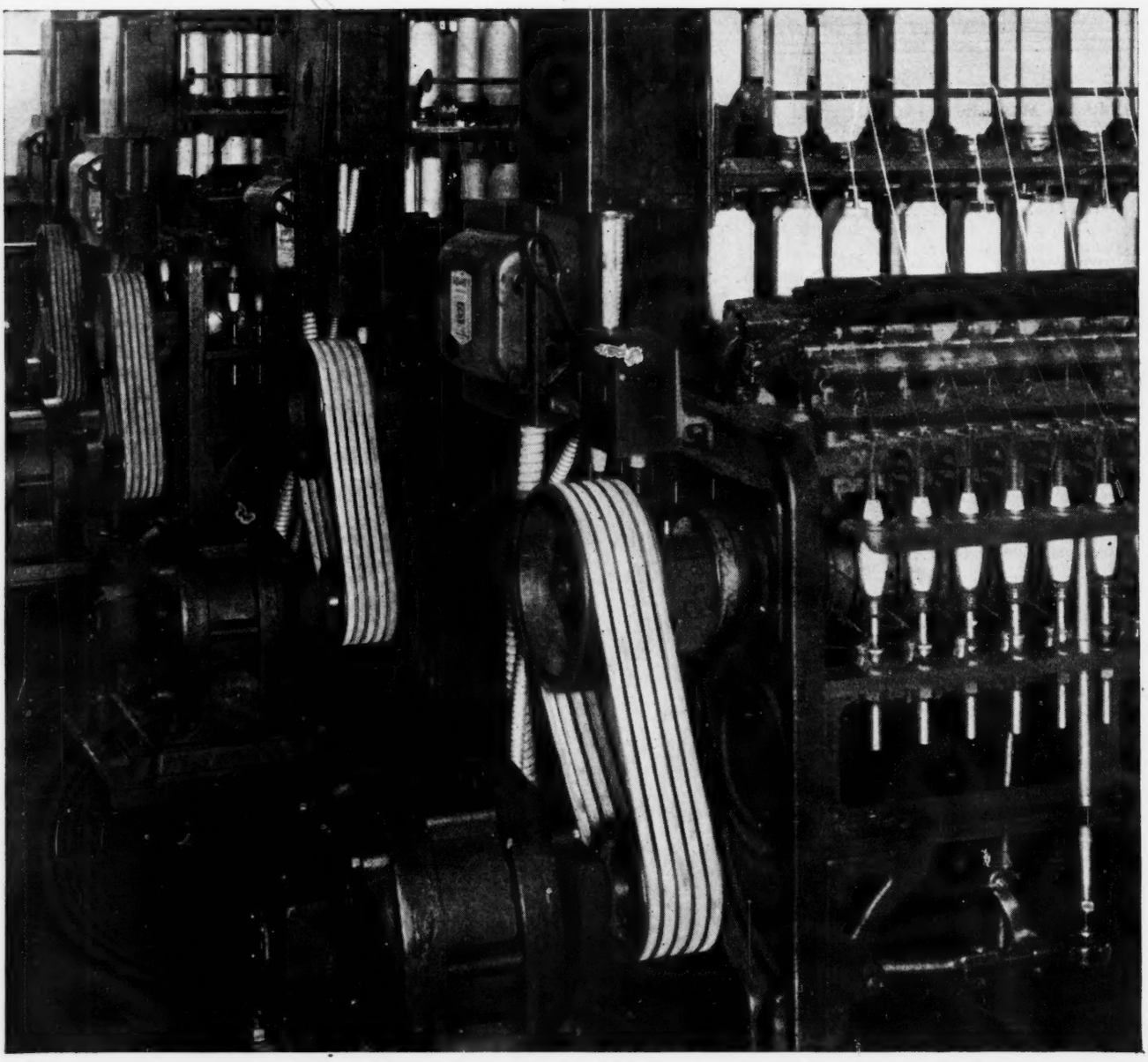
Canadian Distributors:—
The Canadian Fairbanks-Morse Company Limited
15 Branches Throughout Canada



The First Quintuplets—in Belts

A typical example of Goodrich improvement in rubber

YEARS ago Goodrich designed a belt shaped like a "V," to drive the fan on your car. Allis-Chalmers engineers devised a way of using these belts in multiple and they proved so efficient that industry applied them to many kinds of machines.

But no one ever discovered a way to make them exactly alike in length under load. A group of belts might measure the same relaxed but not when under tension. Out of any group two or three would be longer, and so idle around the drive, while the shorter, tighter belts carried the load, and so wore out quicker.

All sorts of devices were tried to arrive at sets of matched belts, of exactly equal lengths, but none was successful.

Then Goodrich engineers went to work, and now for the first time you can buy matched sets of V-belts—as exact as matched golf clubs—each belt sure to carry its full share of the load. The Goodrich development is a machine which automatically measures the belt while it is running under full load. Its length registers on a dial, and is at once stamped on the belt. Then matched sets are assembled.

Again Goodrich research and development give industry a new and better value—the same Goodrich research which has for years been developing new rubber compounds, new fabrics, new combinations and applications of the two—and so developing belting, hose, packing, rolls, tank linings, and hundreds of other rubber products which give you more for your money because they last longer and meet your needs better. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Goodrich

ALL *products problems* IN RUBBER

Another story of Goodrich development work appears on page 11